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ABSTRACT

This booklet is one of a set of learning modules on energy for use by students and teachers in the fourth grade. This module investigates solar energy, ecology, and fossil fuels. Included are laboratory activities and values exercises. (BT)

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ED180805

MAN AND ENERGY

MODULE C FOURTH GRADE

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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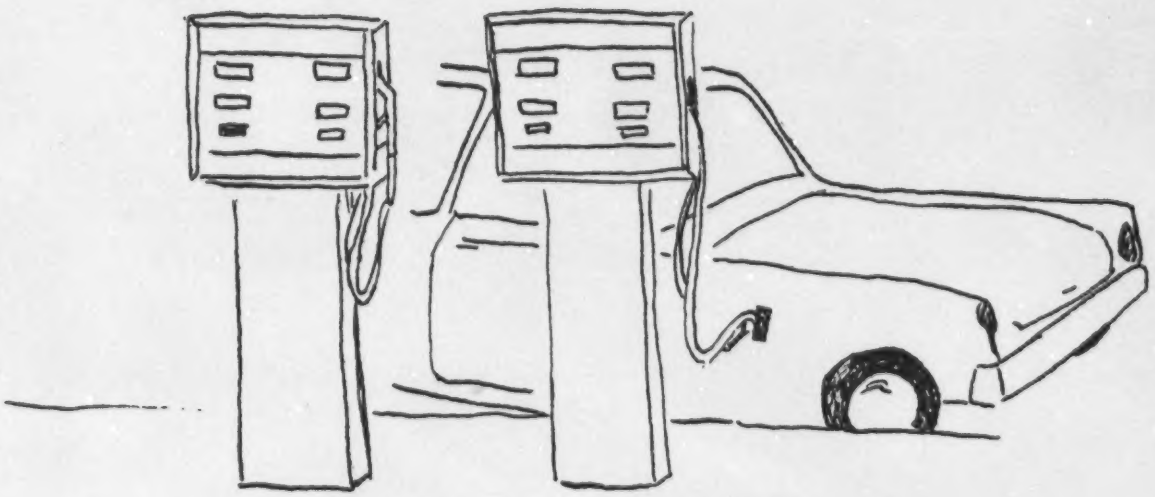
MODULE C
INTRODUCTION

Electricity is probably the most convenient form of energy we use today. It has many advantages and is in great demand. Electricity can be made from many other energy forms, can be transmitted and stored easily and can be converted to other energy forms as we need them.

In this Module you will learn about electricity and how it is produced. One of the facts that you will learn is that most of our electricity is produced by burning fossil fuels. Fossil fuels are also burned for power in machines like automobiles which we have become dependent on in our lives today. Many of the fossil fuels that we are using are running short. L.A.P. Six in this Module introduces alternate sources of energy to take the place of fossil fuels.

Although there are other possible sources of energy, you will learn that we must conserve the sources we have.



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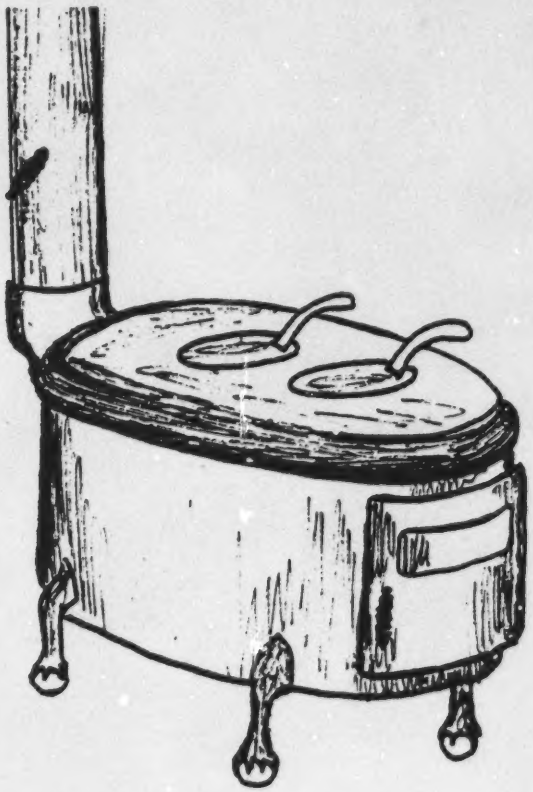
L.A.P. FIVE
MAN'S USE OF FOSSIL FUELS

Energy has always been the key to man's desire to make a better world. Man has used fossil fuels (wood, coal, oil and natural gas) to supply the great amount of energy needed for his better world.

The Chinese used coal on a small scale 2000 years ago. Widespread use of coal as a fuel began in Europe in the twelfth century A.D. It is still used as a major source of energy in a great part of the world. In 1850, 9/10 of the energy used to keep the United States going was obtained by burning wood. By 1900 coal had replaced wood in 8/10 of our energy market. In 1970, 7/10 of the energy used in the United States was from oil and gas. Coal supplied only 1/4 of the energy



Study the chart below.

1. In 1850, what type of fuel was used most?

   _____

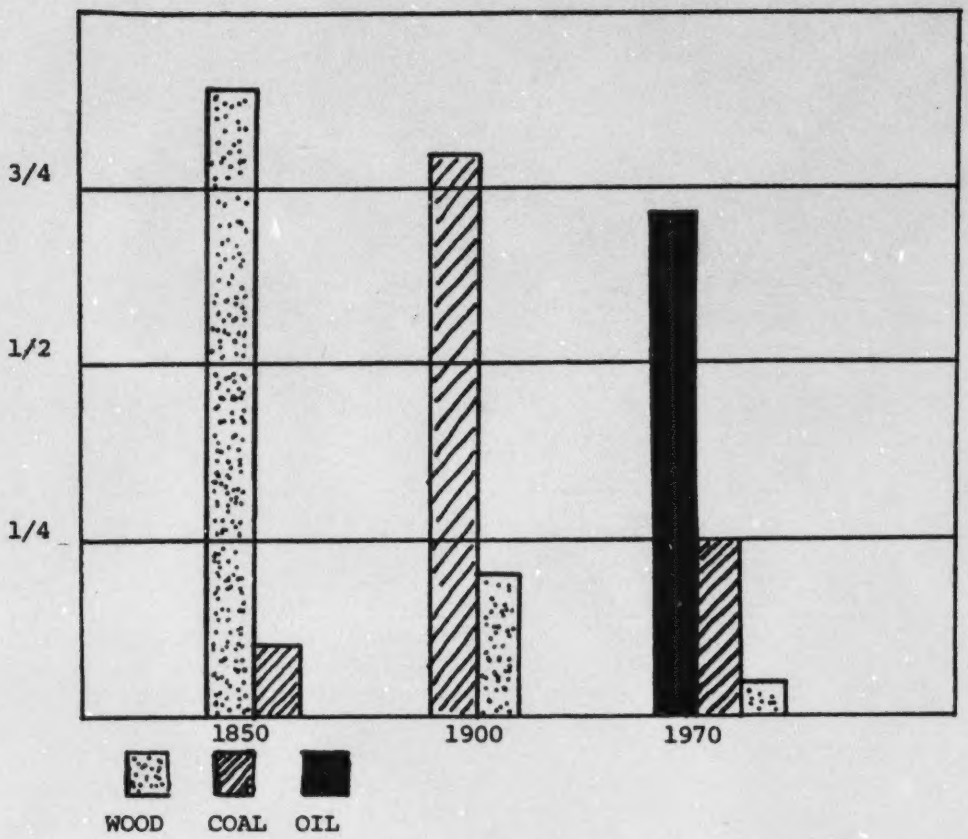
2. In 1900, what type of fuel was used most?

   _____

3. In 1970, what type of fuel was used most?

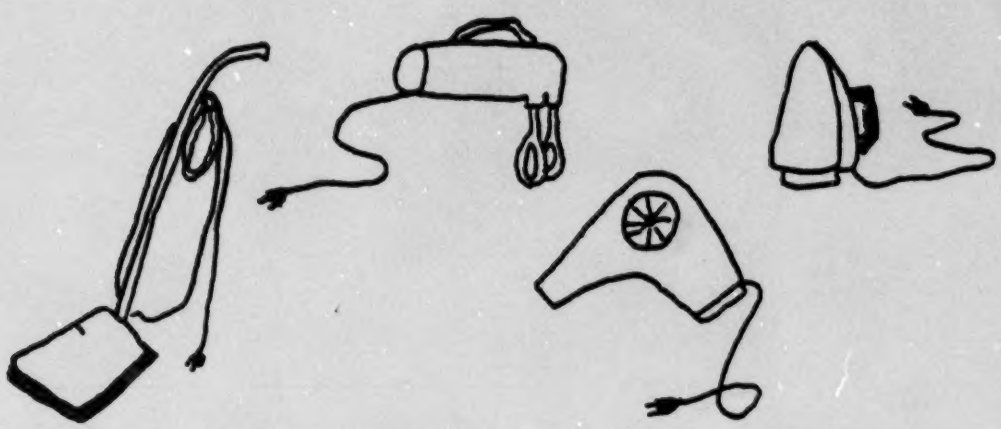
   _____

TYPES OF FUEL USED SINCE 1850



We learn from the information on the page before this that man has used fossil fuels in the past. People still use fossil fuels as a major source of energy. The type of fossil fuel used has changed as man's need for more and more energy grows each year. In a little over 120 years the type of fuel has changed from wood to coal and more and more to oil and natural gas. Why did man have to change the type of fossil fuel he uses for energy?

When we look back in history at man's needs we find that his life was much simpler and he didn't need a great amount of energy. With the passage of time people moved from place to place, to invent and build more and more machines. What man did and is still doing is to make his life more complex. To supply this great amount of energy people had to find less costly and better ways of getting the fuel needed to produce this energy. Man found that coal, oil and gas were best for doing this.



Each year man finds more and more uses for fossil fuels. In 1970 nearly 7/10 of the plastics, synthetic rubber, textile fibers, detergents, medicines and dyes used oil as the source of raw materials. It is hard to believe that oil companies only began in 1857, a little more than 100 years ago. Electricity is the most used form of energy. Today, about 1/2 of electricity used in the United States is produced by burning coal. Oil is used to produce about 1/5 of the electricity.

Everything that mankind does on earth requires energy. Every year man's use of the fossil fuels grows to supply the energy needed to keep our way of life.

L.A.P. FIVE
MAN'S UNLIMITED DEMANDS AND HIS LIMITED RESOURCES

As you know, there is a great demand for energy in the United States today. The United States of America's energy supply comes from six basic sources: Petroleum, Natural Gas, Coal, Hydropower, Nuclear Fission and Wood.

America's demand for energy sources is greater than the resources we have. Therefore, it is necessary to import or bring in sources from other countries.

Facts from 1973 were used to write the table below. It will show you:

1. In the last column - The percentage of each energy source used to supply energy to the United States.
2. In the first column - How much of that source comes from United States Resources.
3. In the second column - How much of that source is imported from other countries.

SOURCE	U.S.A. ENERGY SUPPLY	IMPORT ENERGY SUPPLY	TOTAL ENERGY SUPPLY
Petroleum	30%	14%	44%
Natural Gas (dry)	31%	1%	32%
Coal	20%	3%	17%
Hydropower	4%	NONE	4%
Nuclear	1%	NONE	1%
Wood	2%	NONE	2%
	88%	12%	100%

The major fuel used to supply the U.S.A.'s energy needs is _____ __ ____ ____ ____. We use 2¼ times as much petroleum as coal and 1/3 as much petroleum as natural gas. Since so much petroleum is needed, not only in the U.S.A. but in the world, what would happen if we ran out of it?

You might like to do a report for the class on "The Uses of Petroleum Today".

You might want to find out what countries supply us with petroleum. Make a map marking the countries to put up in the classroom.

EXPANDING GAS ENGINES

Our society uses many machines. From factories to highways these machines do work for man. Each machine has an engine. The engine is the source of power for the machines. Fossil fuels supply energy for the engines in the form of expanding gases. When a fuel like gas or oil is burned, heat energy is produced. The expanding movement of heat energy moves the parts of an engine.

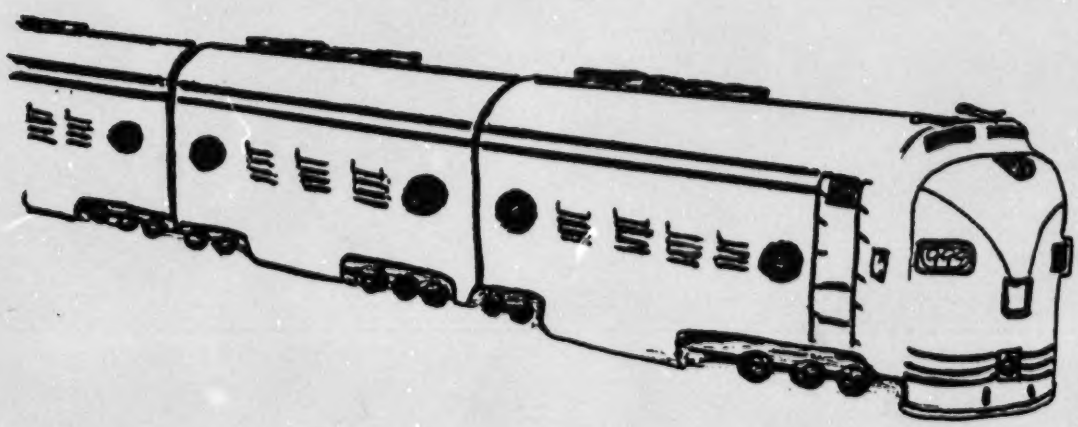
The first engines were powered by steam. They were used with factories and locomotives. Today steam still has a practical use. Electric Power Plants are steam driven. Steam driven engines are too big for automobiles.

Gas Engines are used with cars, boats, lawn mowers and other small machines. Gasoline engines are called Internal Combustion engines. This means the fuel is burned inside a cylinder. The fuel for a steam engine is burned outside the cylinder.

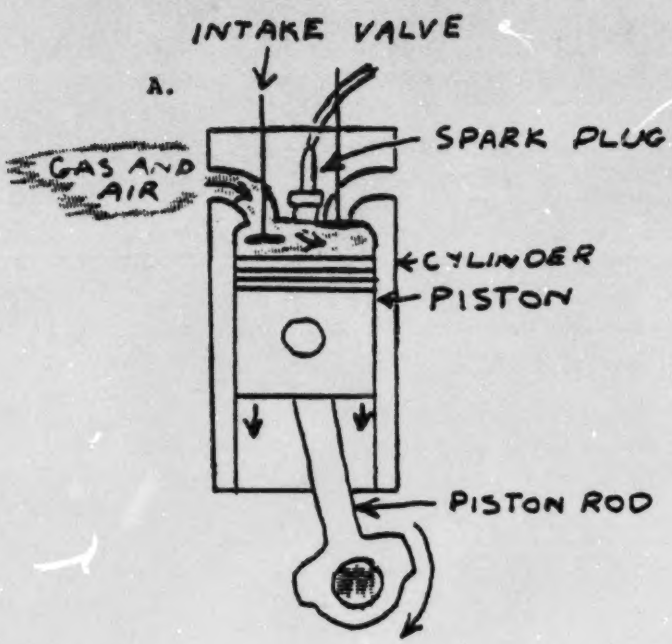
The main parts of an internal combustion engine are the PISTON and CYLINDER. Most cars have 4,6 or 8 cylinders. Large airplane engines have up to 28 cylinders. The piston is a rod-shaped part that fits tightly into the cylinder. When the engine runs, the piston goes up and down in the cylinder. This action turns the crankshaft which runs the machine.

The piston goes through 4 up and down strokes. The four strokes are called:

1. INTAKE
2. COMPRESSION
3. POWER
4. THE EXHAUST STROKE

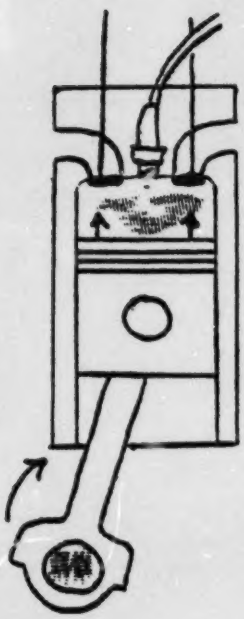


A.



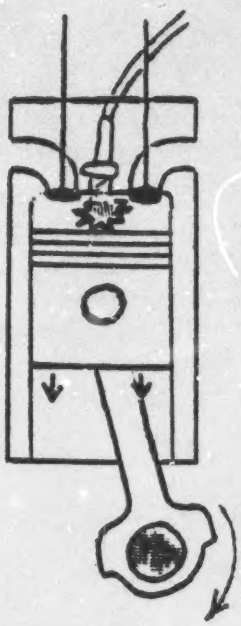
A. The piston moves down and takes in a mixture of gasoline and air into the cylinder

B.



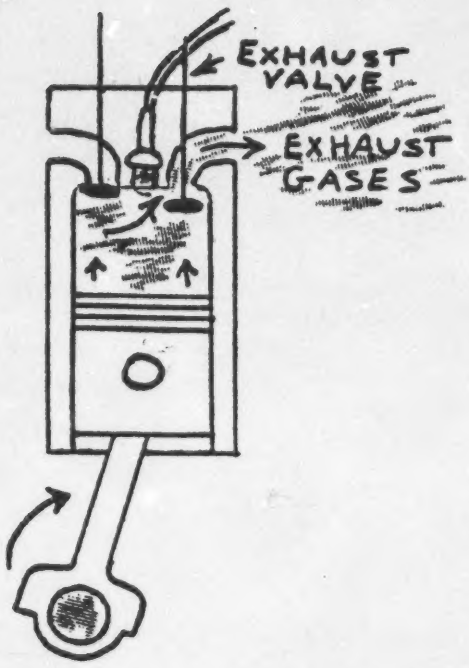
B. The intake valve closes and the piston moves up. This squeezes the fuel and air mixture.

C.



C. An electric spark from the spark plug explodes the fuel. The expanding gas pushes the piston down.

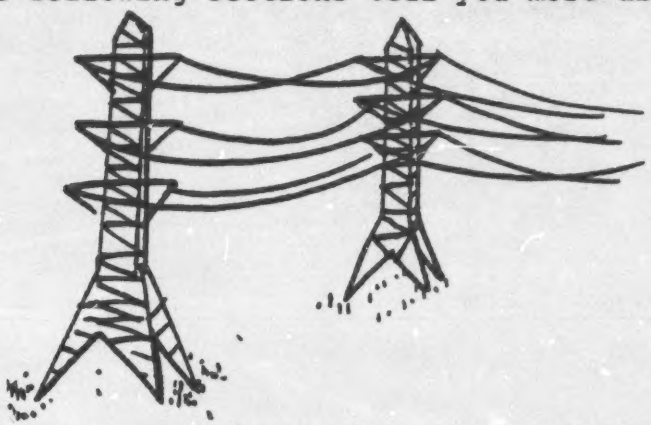
D.



D. The exhaust valve opens. The piston moves up and pushes the burned gases from the cylinder. At this point the first step starts again.

L.A.P. FIVE
ELECTRICITY

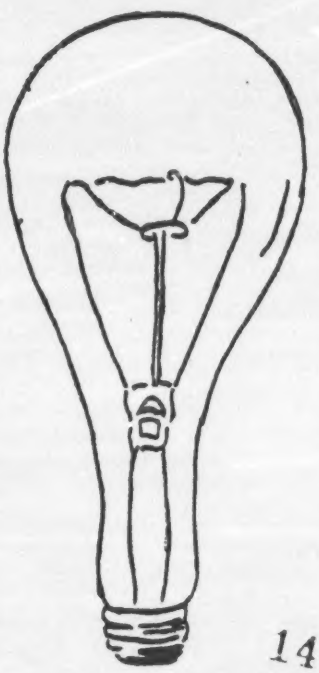
Electricity is a major source of power in our lives today. The following sections tell you more about electricity.



The first section deals with static electricity. You are probably familiar with it already. Have you ever heard crackling noises when you combed your hair in dry weather? Have you noticed the clothes clinging together when taken from the dryer? These are examples of static electricity.

Man has noticed the behavior of electrified objects for centuries. He has not found a way of making use of static electricity.

But his curiousity led to the discovery that electricity can be in motion. We call this current electricity. Man has learned to control and produce electric current.



The second section tells how current electricity, the electricity used in our homes, is produced.

It is possible to keep a record of the amount of electricity used by reading the electric meter. You will learn how to read electric meters in the third part.

Finally, you will find out about the kinds of work men do in producing electricity.

LAB ACTIVITY
PRODUCTION OF STATIC ELECTRICITY

The following are suggested activities to help you understand the characteristics of static electricity. Your teacher will decide in what manner you will do the experiments.

EXPERIMENT 1

Materials Needed: Hard rubber comb

Comb your hair with the hard rubber comb or rubber rod. When you bring the comb near your hair after combing, the negative charges on the comb attract the positive charges on the hair, causing strands of hair to lean towards the comb. Electrons jumping to the hair should cause a crackling sound.

EXPERIMENT 2

Materials Needed: Tissue paper, hard rubber rod, wool cloth

Place small bits of tissue paper on a table, and rub a hard rubber rod on a wool cloth. When you place the comb near the tissue paper tha small pieces will be drawn towards the comb.

EXPERIMENT 3

Materials Needed: Balloon, wool cloth

Blow up a balloon and tie it closed. Rub the balloon on a piece of wool. Then place the balloon against a wall, and static electricity will hold it there.

EXPERIMENT 4

Materials Needed: 2 balloons, string to hang balloons from, wool cloth

Blow up two balloons and suspend them from two strings. Rub each balloon with a wool cloth and when the strings are held in one hand the balloons will repel one another.

EXPERIMENT 5

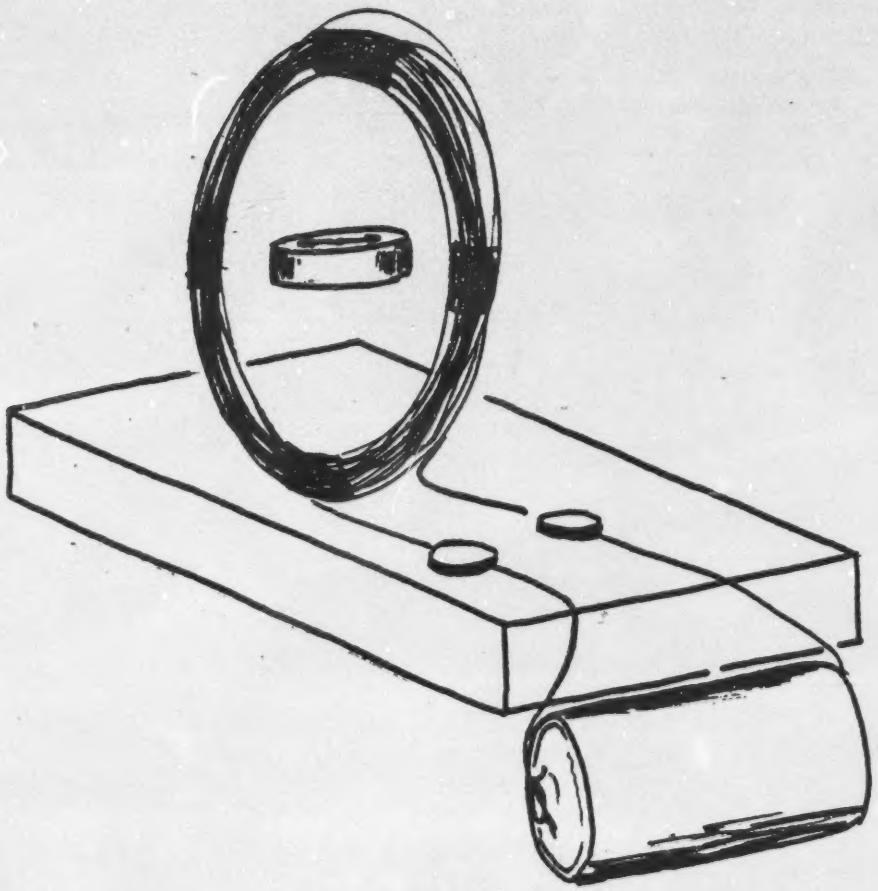
Materials Needed: A piece of wool carpet

Place a piece of wool carpet on the floor near a door. Rub your feet on the carpet and while still standing on the carpet, reach out with one finger to touch the door knob. A spark will jump from the finger to the knob.

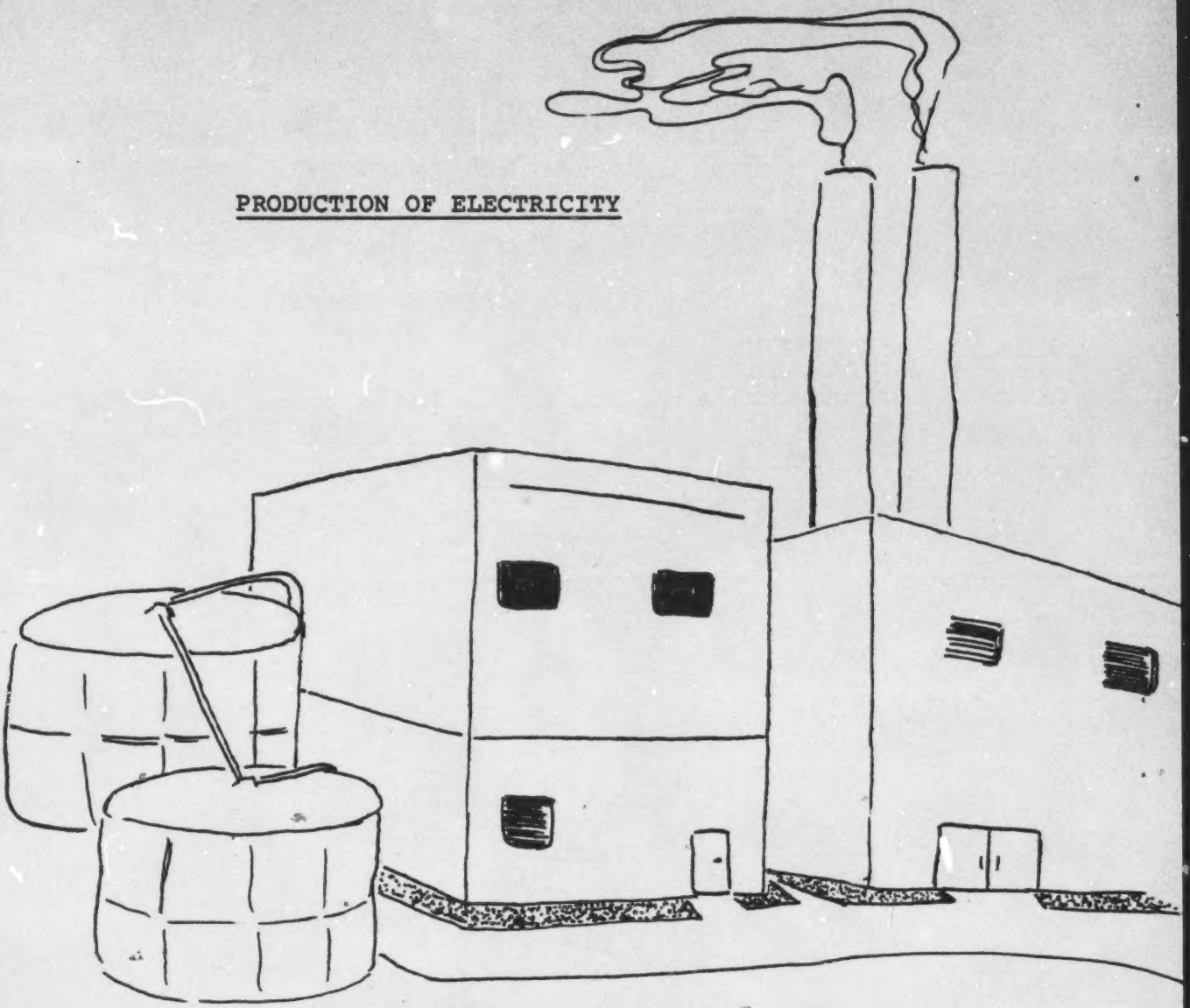
EXPERIMENT 6 - Construction of a Current Detector

Materials Needed: One roll of bell wire, adhesive or electrical tape, small wood board 4" x 4", small compass, two thumbtacks, No. 6 battery.

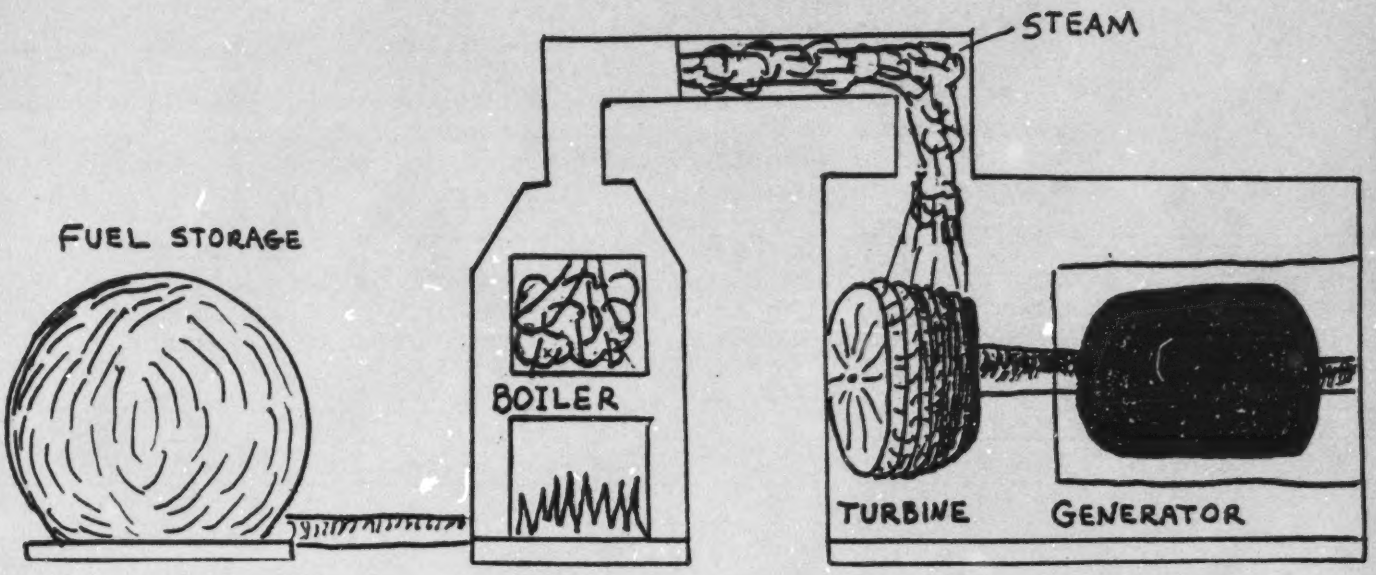
1. Unwind 12" of wire from both ends of the roll.
2. Tape roll of wire in four places to keep it together.
3. Strip one inch of insulation from each end of wire.
4. Place the roll of wire on one end of board in an upright position. Tape it in place.
5. Push two thumbtacks partially into board approximately two inches apart. Wrap one wire around each tack, then push tack in board to hold insulated wire in place.
6. Place compass in coil of wire so that it is level. (Needle must be able to turn freely.)
7. Connect each wire to battery momentarily. This will cause compass needle to swing.



PRODUCTION OF ELECTRICITY



Electricity is the most used power today. It's all around you. Lights are on. Toasters pop. Buses start. Traffic lights change. Bells ring. Gears turn in factories. Electricity keeps things going!



Electricity is produced by steam energy in POWER PLANTS. Coal or oil is burned for the heat energy to boil water. Boiling water makes steam. The steam pushes against TURBINE blades. It causes them to spin. The blades are connected to the shaft of the GENERATOR. The generator produces electric energy. A magnet spins inside coils of wire in the generator which makes electricity. The electricity flows through wires to the community.

ACTIVITIES

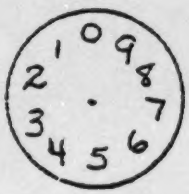
1. Make a collage of things that use electricity.
2. Draw a map to trace electricity from your home to the closest transformer then to the power plant.
3. Write to local power companies to determine the fuel they use and the quantity used.
4. Arrange in proper order the parts of a power plant. Fuel---Boiler---Turbine---Generator---Powerline
5. List things we would not have or could not do without electricity.
6. List jobs that could be found around a power plant.
7. Prepare a chart of the kilowatts used by the appliances in your home.

L.A.P. FIVE
HOW TO READ AN ELECTRIC METER

Electric meters measure electricity in kilowatthours. A kilowatthour is 1,000 watts of electricity used for one hour. Ten 100 watt light bulbs burning for one hour would use one kilowatthour.

Most electric meters have five dials. They are read from right to left. The dial on the right shows us kilowatthours. The next dial shows tens of kilowatthours, the next dial hundreds of kilowatthours, next thousands of kilowatthours and the last ten thousands of kilowatthours.

10,000's



1,000's

100's

10's

1's

An electric meter is like the odometer in a car, it gives a total. Let's find out how much energy you use during a span of time. You must look at readings made at the beginning and end of the time span.

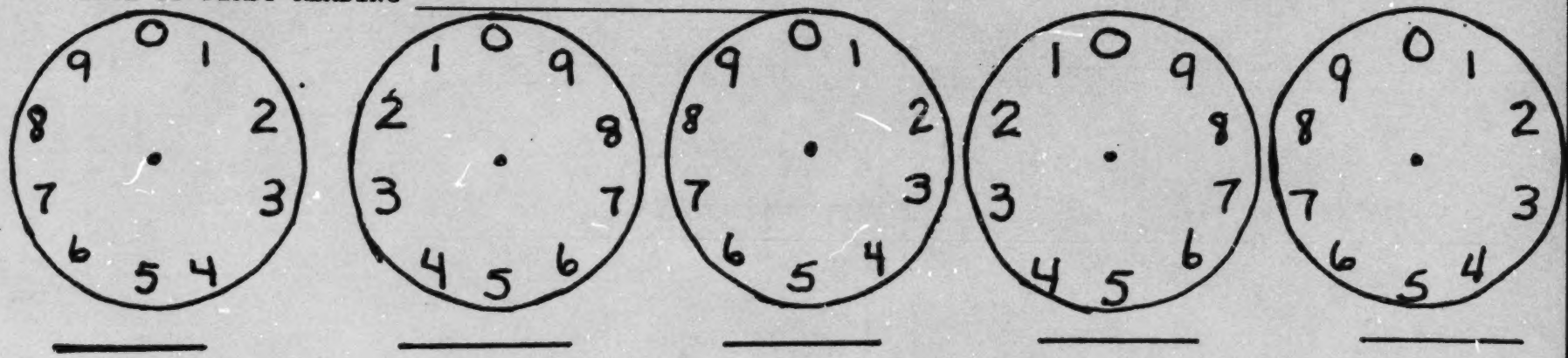
For example, suppose that your meter reads 13478 on Monday and 13488 on Tuesday morning. This means that your home consumed 10 kilowatthours from Monday morning to Tuesday morning (one day).

```
 13488
-13478
   10 kilowatthours
```

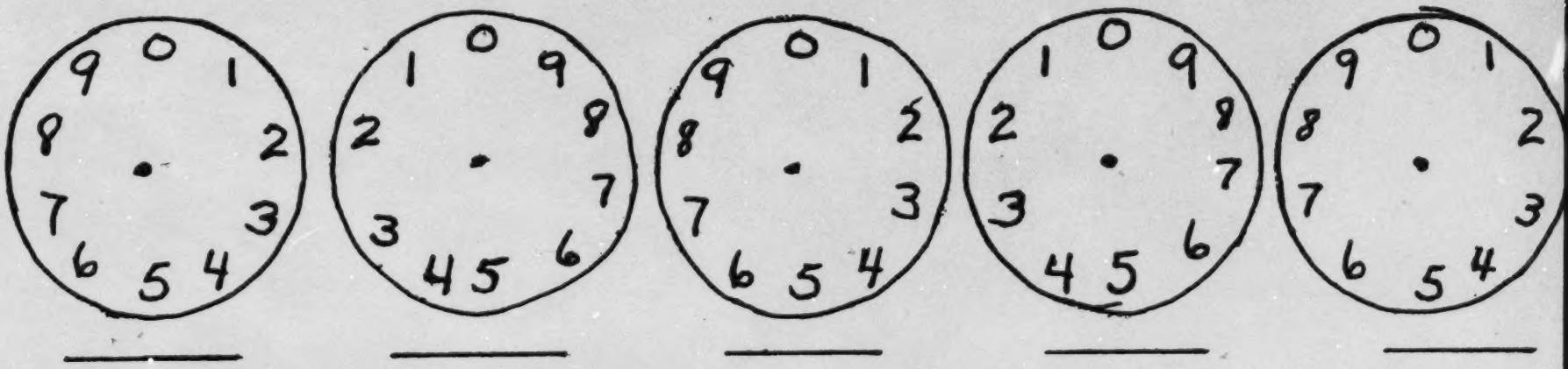
Fill in the amount of electricity used on these meter dials.

_____ _____ _____ _____ _____

DATE OF FIRST READING _____



Read your meter at home. Fill in each dial and mark the date. Read the meter at a given time later and label dials. Subtract the first reading from the second to figure how much power your family has used.



DATE OF SECOND READING _____

L.A.P. FIVE
JOBS IN ELECTRICAL PRODUCTION
CAREER SHEET

In the past few weeks you have been learning about energy. You have also learned about jobs in energy. Now, you will study the kinds of jobs there are in ELECTRICITY PRODUCTION.

As you know, most of the machines and appliances in your home work because of E __ __ __ __ __ __ __ __ __ __. Production means the making of something. The places that make electricity are called POWER PLANTS. Do you remember how electricity is produced?

In the power plants you could work as a COAL HANDLER, MACHINIST and MACHINE MECHANIC.

How does the electricity get from the plant to your home? If you don't know maybe this next job will give you an idea. In Electricity P __ __ __ __ __ __ __ __ __ there are men who work as LINEMEN and GROUNDMEN TRUCK DRIVERS. You might see them climbing the poles beside the road.

Then there are people who work in the field and company. There are DRAFTSMEN, SURVEY TECHNICIANS, METER READERS, KEYPUNCH OPERATORS, and CLERKS. All these jobs deal with the electricity making business.

Here is a description of each of these energy-related jobs:

COAL HANDLER - His job is to inspect and repair an automatic conveying machine that brings coal into the power plant.

MACHINIST - His job is to check plant equipment and operate a steam electric station.

MACHINE MECHANIC - This person fixes the engines and machines that have broken down.

LINEMAN - This person fixes the wires and poles that carry electricity to your home. Linemen sometimes work long hours fixing the damage after storms.

GROUNDMAN TRUCK DRIVER - This job is to help the lineman by getting him equipment and material he needs.

DRAFTSMAN - There is a lot of drawing to do in this job. You have to make maps, or field sketches.

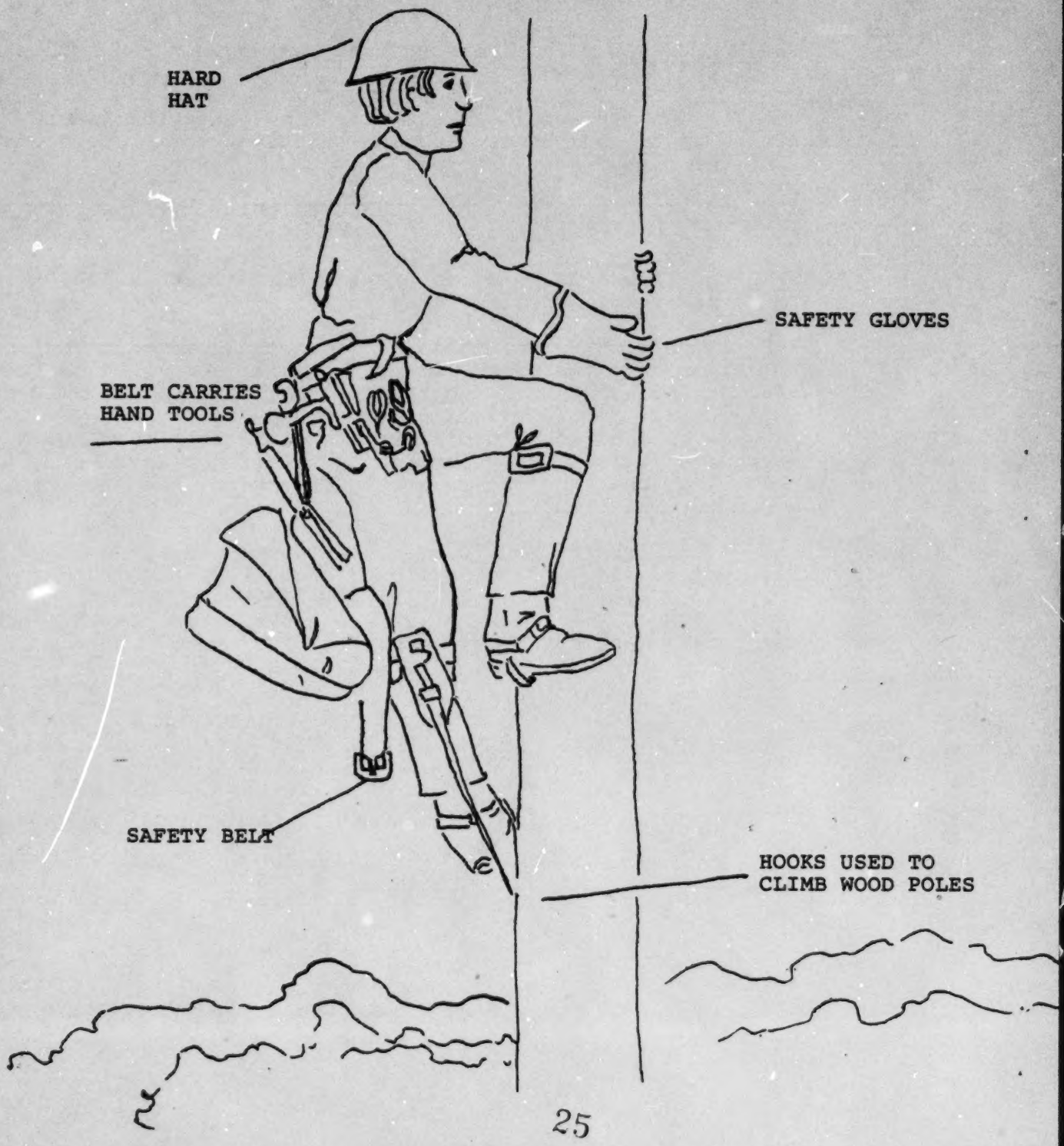
SURVEY TECHNICIAN - You might have seen this person. They get information that the draftsman use to make maps. You see them measuring and looking through scopes.

METER READER - At your home there are dials that show how much electricity you have used each month. This job involves going to homes and checking the meters to figure out how much money you owe for the electricity.

CLERK - This job deals with over-the-counter work, handling mail, typing, and record keeping.

KEYPUNCH OPERATOR - You have to know how to type for this job. These people make cards for computers.

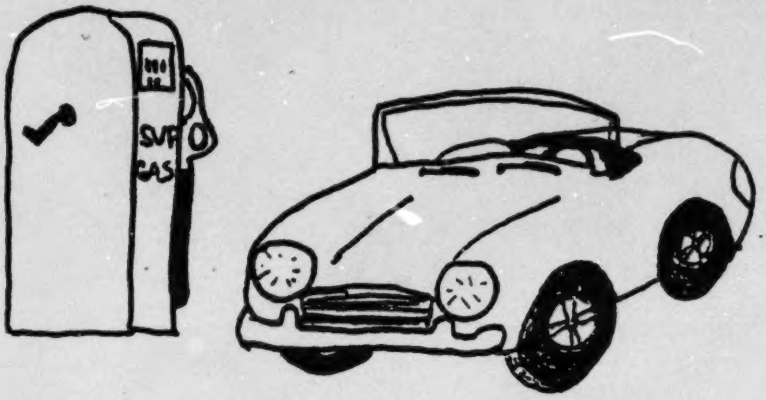
THE MAN BELOW IS A L _ _ _ _ _ _ _ _.



L.A.P. FIVE
ENERGY CONSERVATION

At one time, man lived in a cave and killed animals for food with a club. There were no machines around to do his work for him. But, man found other ways to get his work done.

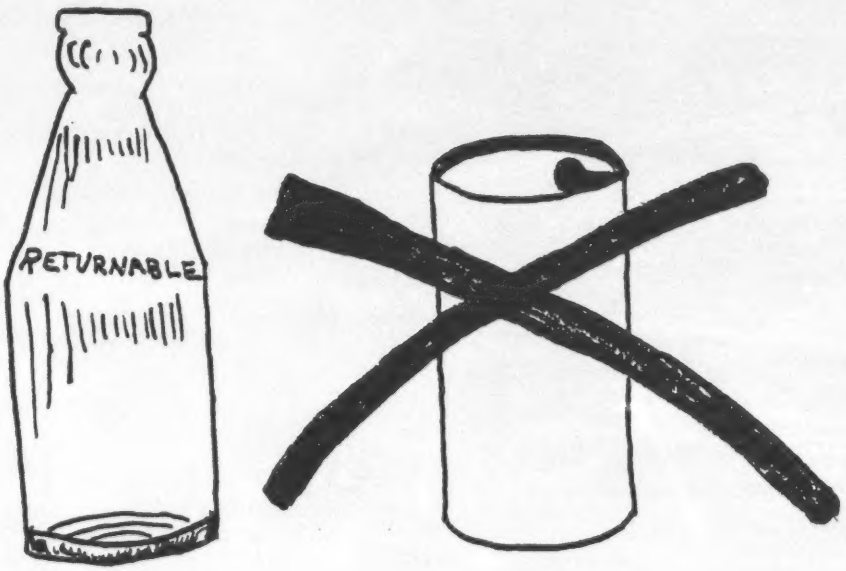
Electricity is now used to do much of man's work. Man has raised his standard of living. Man now uses too much of the earth's energy. If he does not change he will pay by running out of the resources that make electricity. Man must become more unselfish and conserve. Man must wake up and see that our sources of power are limited.



Each boy and girl can help with the problem. There are many things that one person can do.

First, let's see how we are using our resources of electricity. We use products that need electrical power in order for them to be made. Not only the products, but the containers are made of plastic, metals such as aluminum, tin, glass and paper. Think of the amount of paper items we use in our homes, such as napkins, toilet tissue, tissues and paper towels.

All of these items need electricity to be produced. What can we do about using less energy for making products? Well, we could stop buying drinks that are not in returnable bottles. Ask your grocer to sell drinks only in returnable bottles. Some companies are now trying to make containers that will self-destruct. They are called biodegradable containers. We could ask our parents to use soap instead of detergent for laundering. Detergents are not biodegradable, and use more electricity at the sewage treatment plants than soaps.



We could ask our parents to support laws to build recycling center. Our community could recycle glass, plastic, metal and paper products. Some areas of the country have used shredders for plastic containers and crushers for glass containers This material is used for road beds.

We use power daily for lights, appliances, air conditioners, TV's, radio's, record players, clothes dryers, washers, dishwashers and so forth. What can we do about this use of electrical energy? Become "electrical switch aware" by turning off all electrical switches when they are not in use. Ask your parents to use less electricity when possible by hanging clothes outside to dry instead of using electric dryers. You can ride your bike, use car pools, or mass transportatio rather than always using gas. Be a watt saver by using light bulbs that require less electricity. Recently Duro Lite made a "watt saver" bulb. It uses less watts per lamp and lasts longer.

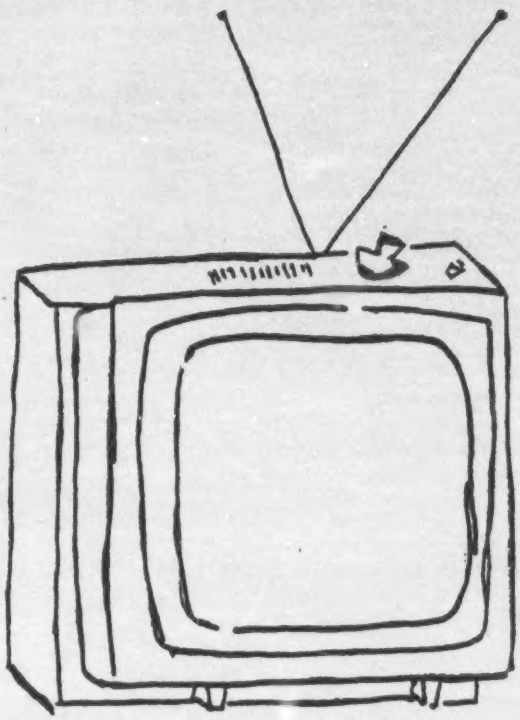
Use less water because we have water shortages. More electricity is used to cleanse the water when more water is used.

At this time the President of the United States is greatly concerned about the environment and the ecology of our country. He realizes that there is a shortage of natural resources and therefore electricity. He would like for us to care enough to act now. Who must act? We must. Why? So we can have life in the future as we know it now and not from a cave where man started.

L.A.P. FIVE
NECESSARY VERSUS UNNECESSARY USE OF ENERGY

"Who left the light on in the bedroom?"

"Who left the T.V. on?"



"Who forgot to turn off the radio?"

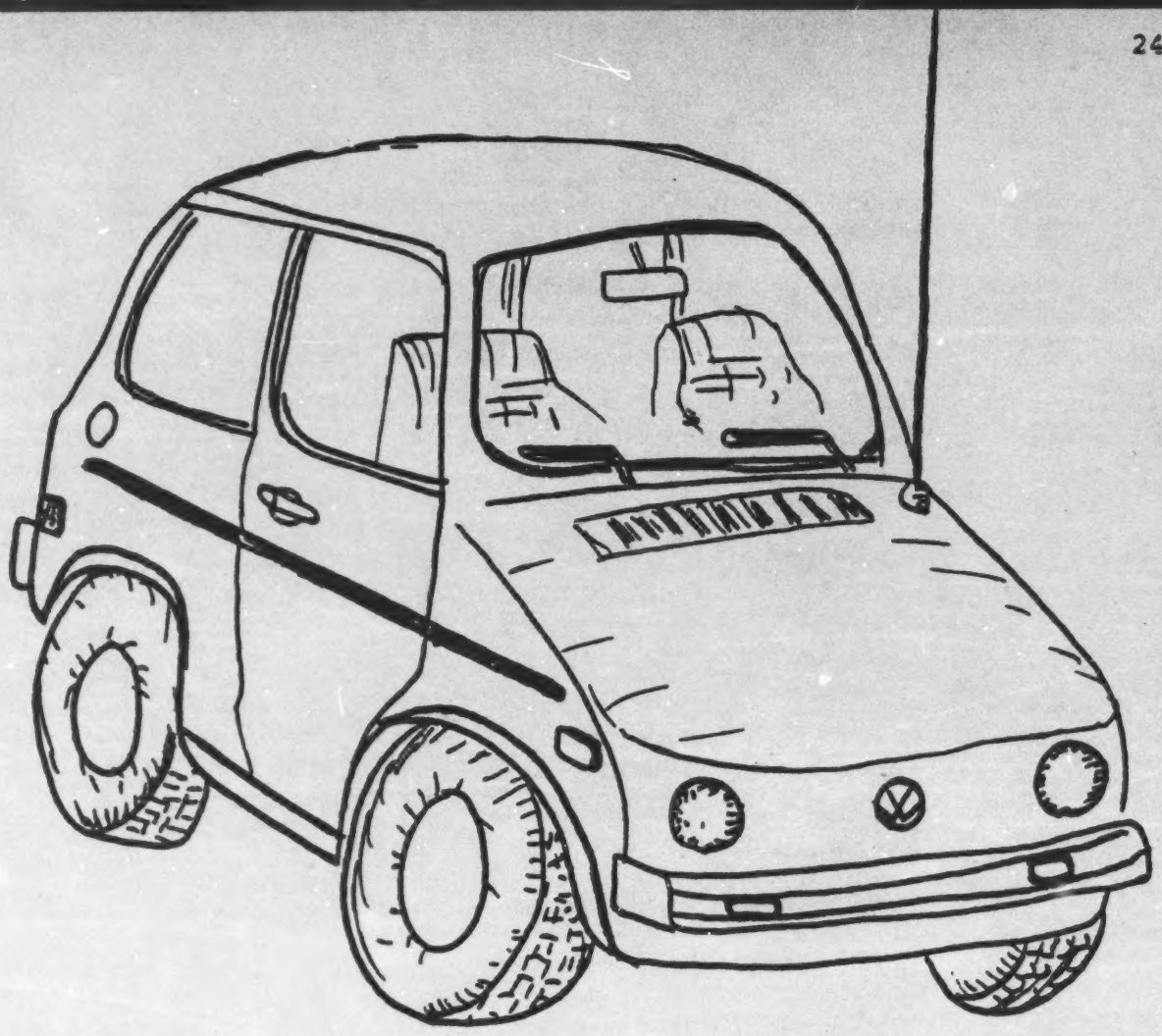
"Who went away and left the record player playing?"

"You have opened that refrigerator door 1000 times in the past hals hour!"

"Please close the door, we have the air on."

"It is easier for me to put the clothes in the dryer even if the sun is shining."

"I know it's only a short distance, but I don't feel like walking. Please take me in the car."



How many times each day do we say or do the above types of things? We can probably think of many other ways of wasting energy. We all use large amounts of energy without thinking about it. In some cases it's necessary for us to use energy to do our work, to keep our health and make our life more safe. We need energy to travel to school. We use it to help do our school work. Dad and Mom need energy to help them do their work. When we think about it all the world uses and needs a large amount of energy.

All this energy seems to come to us so easily. We flip a switch or push a button and we have instant light or a T.V. program. Since this energy does come so easily, we don't think about where it comes from, or how much of it there is. MOst of us have habits that waste energy. Re-read the beginning of this L.A.P. and you will see that we do many of these things that waste energy. We do these actions from habits that we get from doing the same thing over and over again.

We should try, as students, to start in our own homes to save energy. Let's become leaders in our family by setting an example in saving energy. We can make our own list at home showing the necessary needs we have for energy. Once we get into the habit of checking our energy list we will start saving energy. This will help us to use energy when it's necessary and stop our unnecessary use of energy.

The sooner we start the practice of saving energy, the sooner we will have good energy-saving habits. We will be the ones to benefit in our future years if we start our energy-saving habits now.

ACTIVITY: Look around the room. What things and what people are using energy?

ACTIVITY

Color all the items in the house on the next page RED that would not run if there were no power.

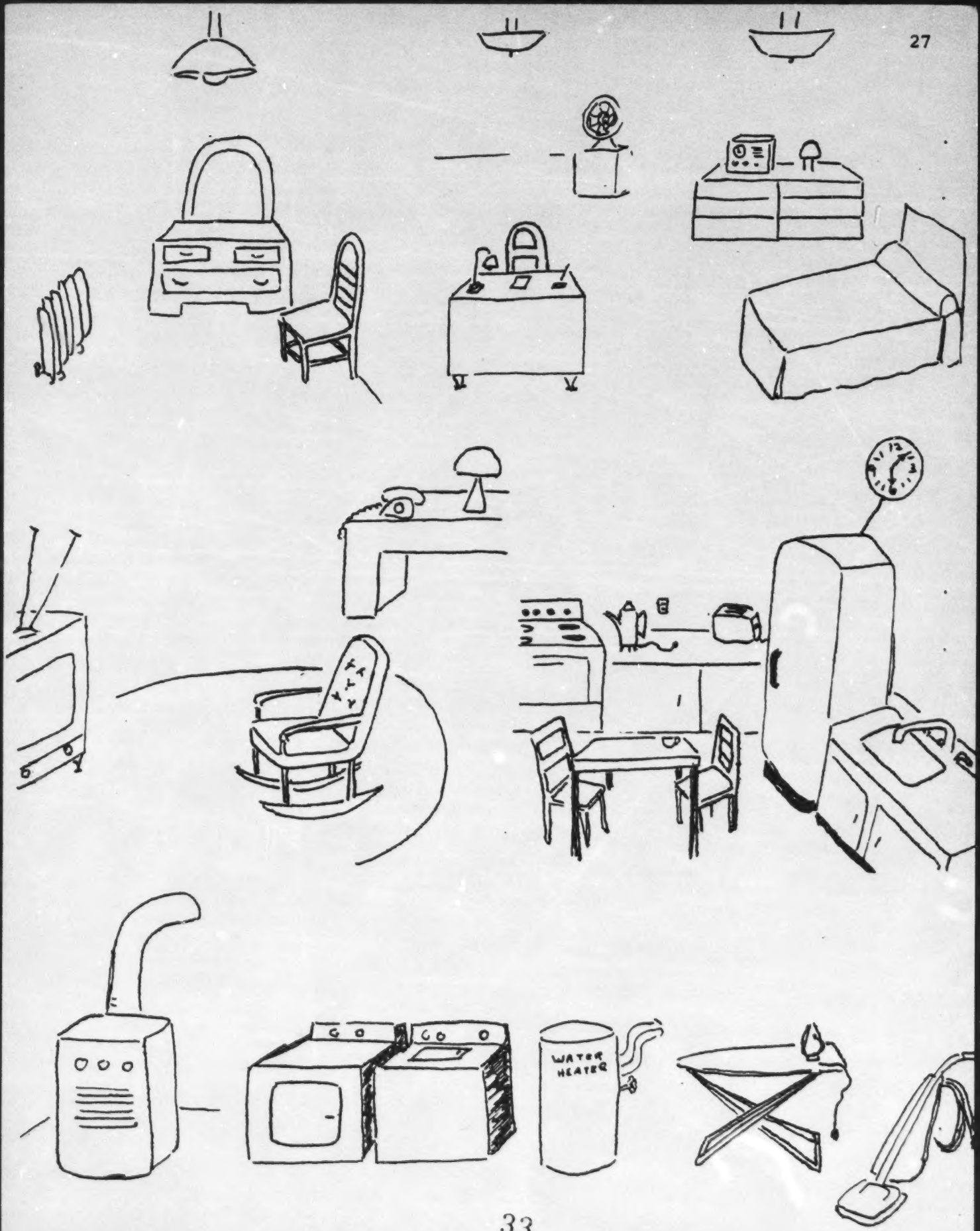
Now, color all the items BLUE that would not work if there were no fresh water sources left.

For each thing you colored RED try to name a substitute item that would work under the same conditions.

1. SUBSTITUTE LIST:

2. List here the things you could live without from the picture on the last page.

For each thing you colored BLUE, is there a substitute item that would work?


WATER
HEATER

L.A.P. SIX
OTHER ENERGY SOURCES

In the United States we get nearly all of the energy we use by burning oil, coal, and natural gas. These fuels are called fossil fuels because they were formed from plants and animals buried in the ground millions of years ago.

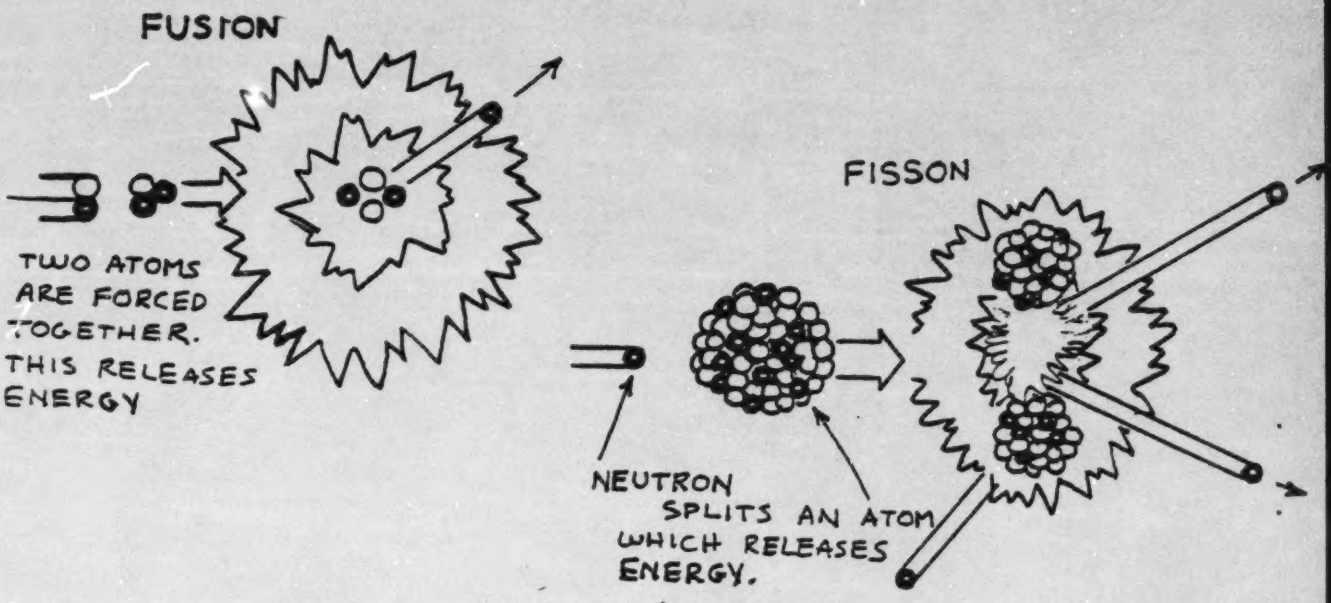
There is only a limited amount of these fossil fuels in the ground. We are now burning them up so fast that they will probably be used up in less than two hundred years.

It is important that we find other sources of energy to take their place. There are many ways in which we can get energy without burning fossil fuels. Energy can be obtained from atomic fuels, moving water, winds and sunlight.

All around the world, in hundreds of different laboratories, thousands of scientists are searching for new sources of energy. Let's look into some of these other possible sources.

ATOMIC ENERGY

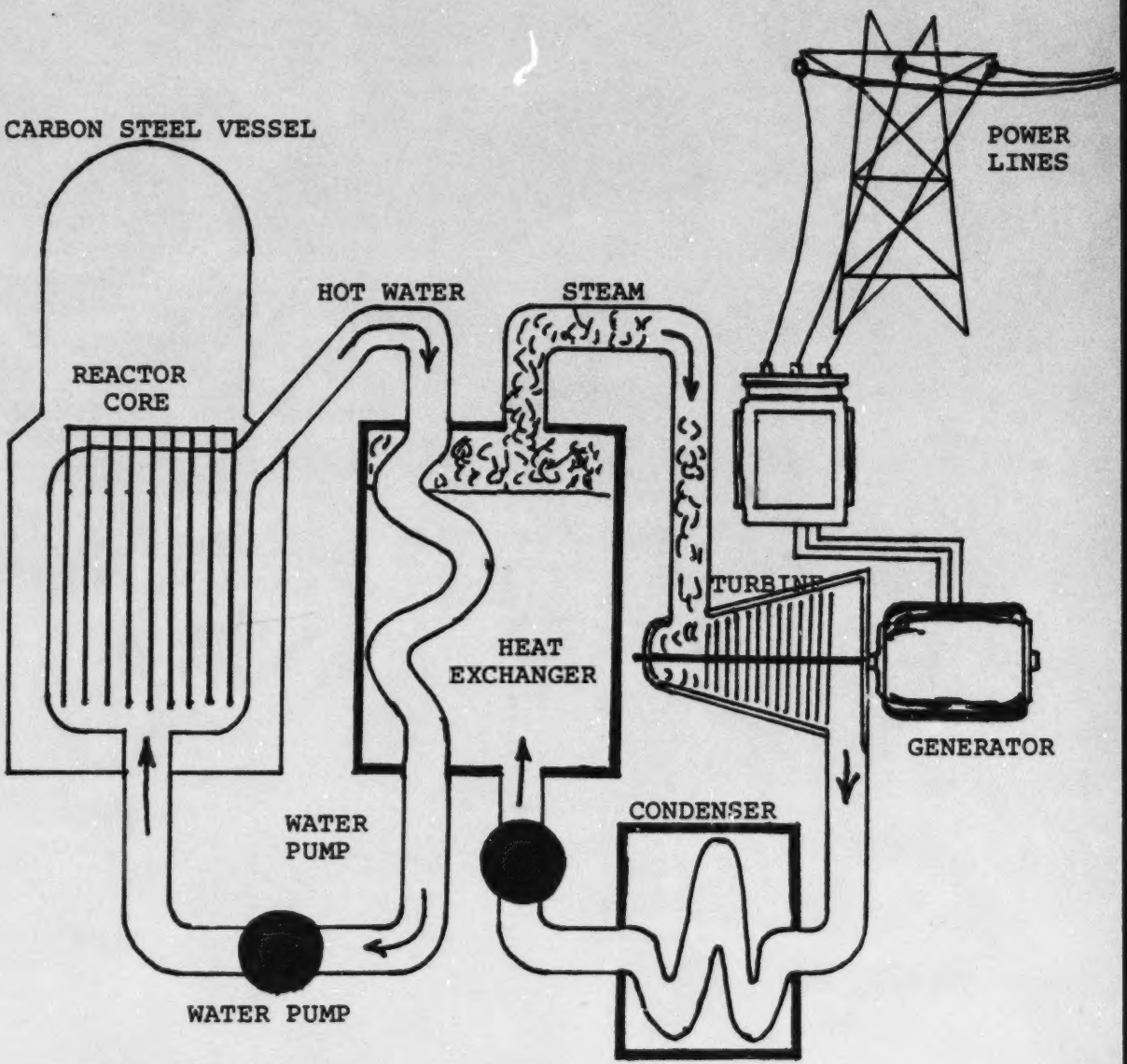
The energy that is stored inside an atom is called NUCLEAR ENERGY. There are two ways of getting nuclear energy. One way is to split certain very large atoms into samller atoms. The other way is to join atoms. The first way is called FISSION. The second way is called FUSION. In both ways, some of the parts of the stoms are changed into free energy.



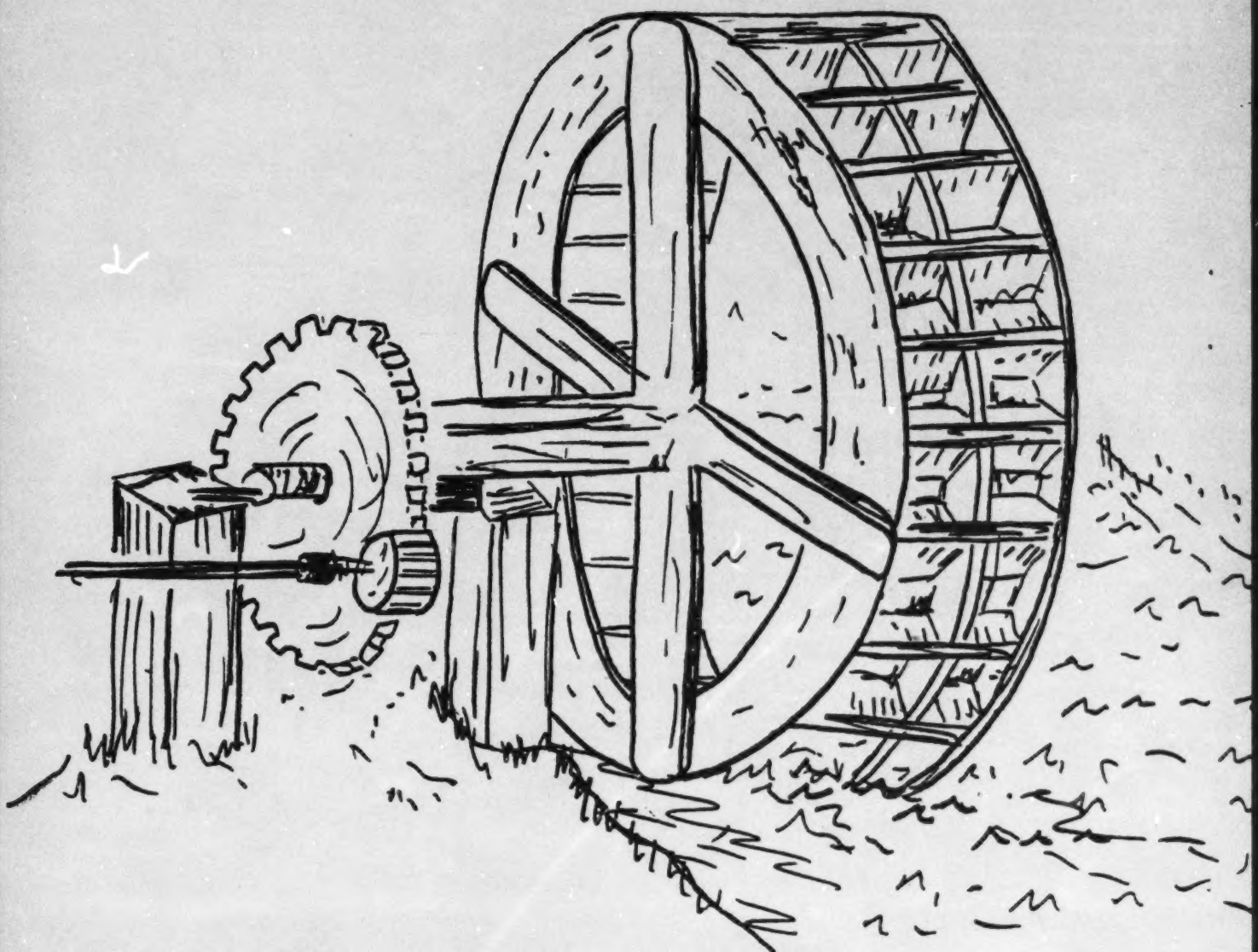
There is only one kind of atom found in nature that can get energy by fission. It is a kind of URANIUM. There are two other kinds of atoms that can be used for fission. They are not found in nature. The atoms that can make energy by fission are called NUCLEAR FUELS. When nuclear energy is released very fast, there is a great explosion. Bombs that make this kind of explosion are called ATOMIC bombs.

If the nuclear energy is released slowly, the energy can be caught and put to work. Energy made by nuclear fission is released slowly in what is called a NUCLEAR REACTOR. Scientists are still trying to find ways of slowly releasing the energy made by nuclear fusion. Some nuclear reactors are now being used to make electricity and to drive ships and submarines.

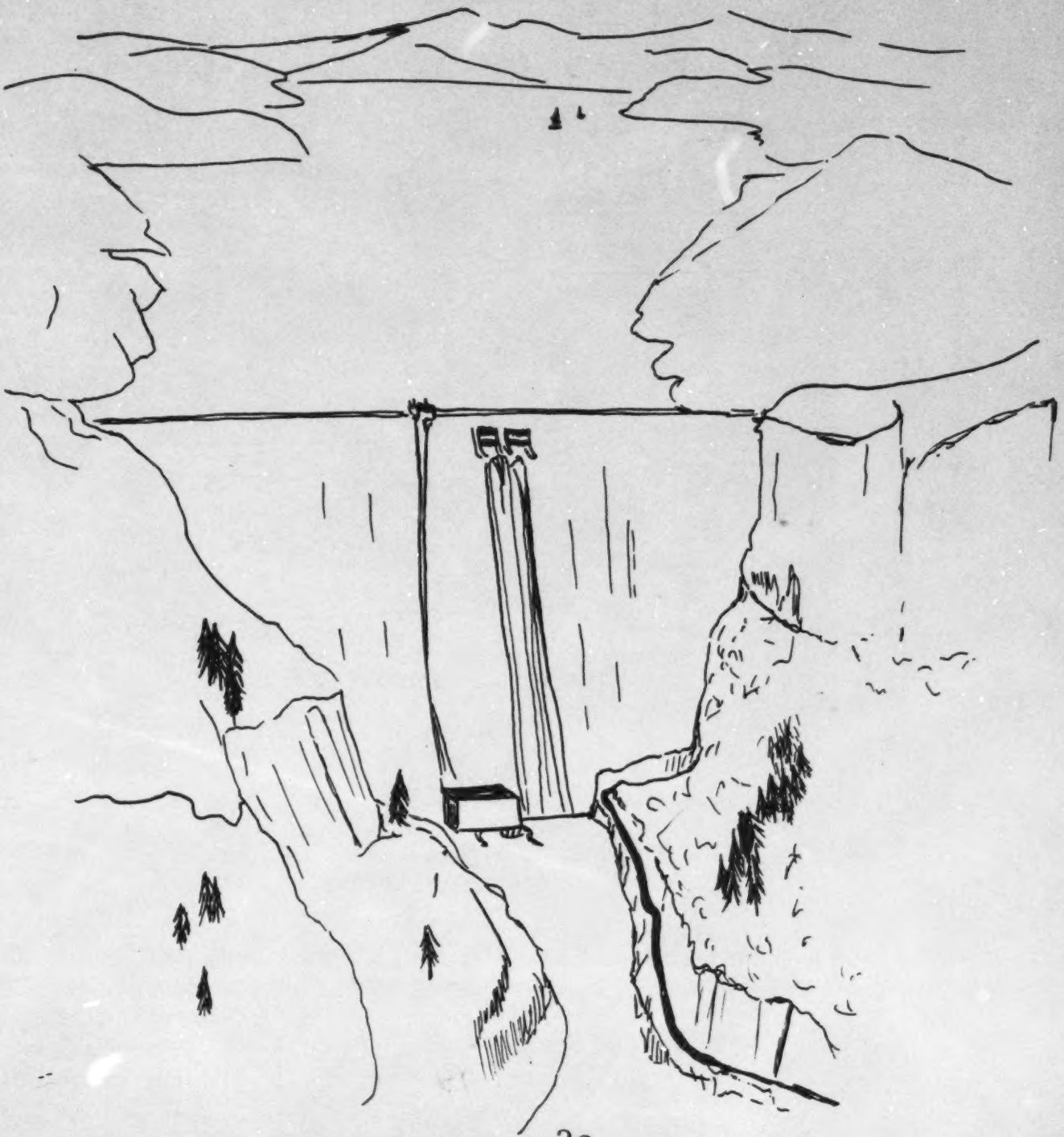
In the United States, nuclear reactors now supply small amounts of energy. More nuclear reactors are being built. As the fossil fuels are burned up, nuclear fuels will probably take their place. A small amount of nuclear fuel can produce a large amount of atomic energy.



Long ago man used moving water as a source of energy. It was used to turn a wheel for grinding wheat, sawing wood or pumping water. Water can be used in these and other ways today. Water falling over a dam or falling through pipes is used today to produce electricity. The weight of the falling water spins water turbines. The turbines turn generators to produce electricity.



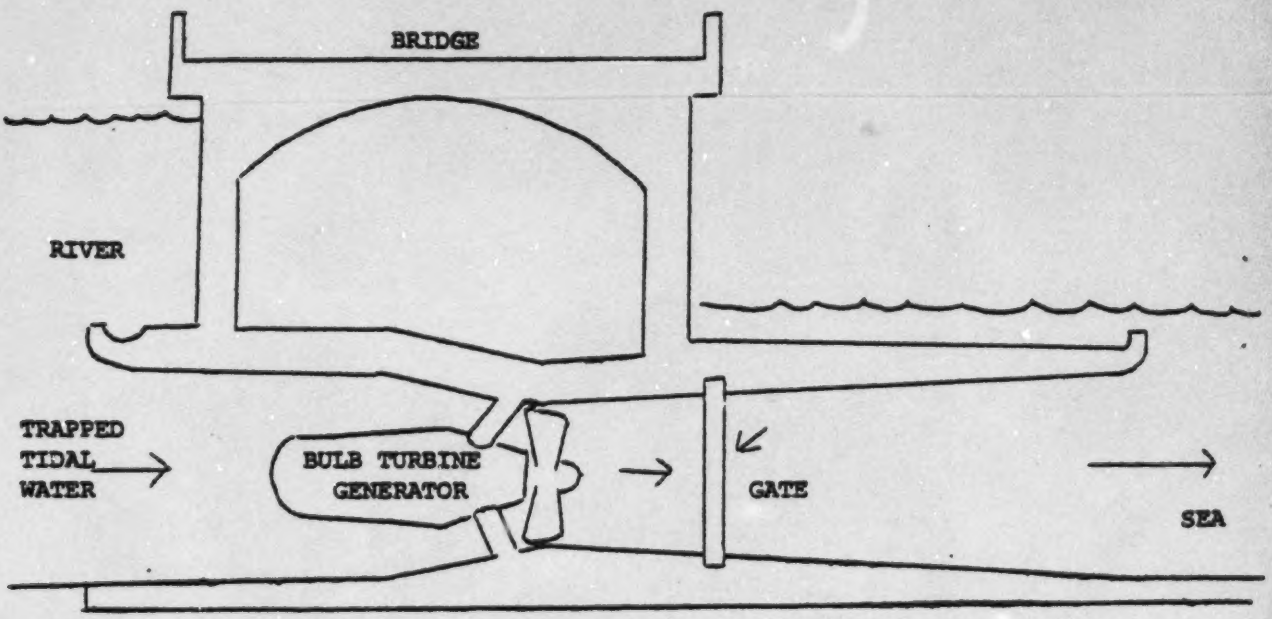
Water power now supplies a part of the electric energy used in the United States.



TIDAL POWER

Another form of moving water that may be used is found around oceans. Each day the level of the ocean water rises and falls. This action is called high and low tide. Tidal generators have been built to trap tidal water. Basins, turbines and generators are built into enormous dams. As the tide rises, the basins fill with water. After the tide goes out, the water locked in the basins is let out. The rushing water drives the turbines, thus powering generators.

This illustration shows how a tidal generator in France works.

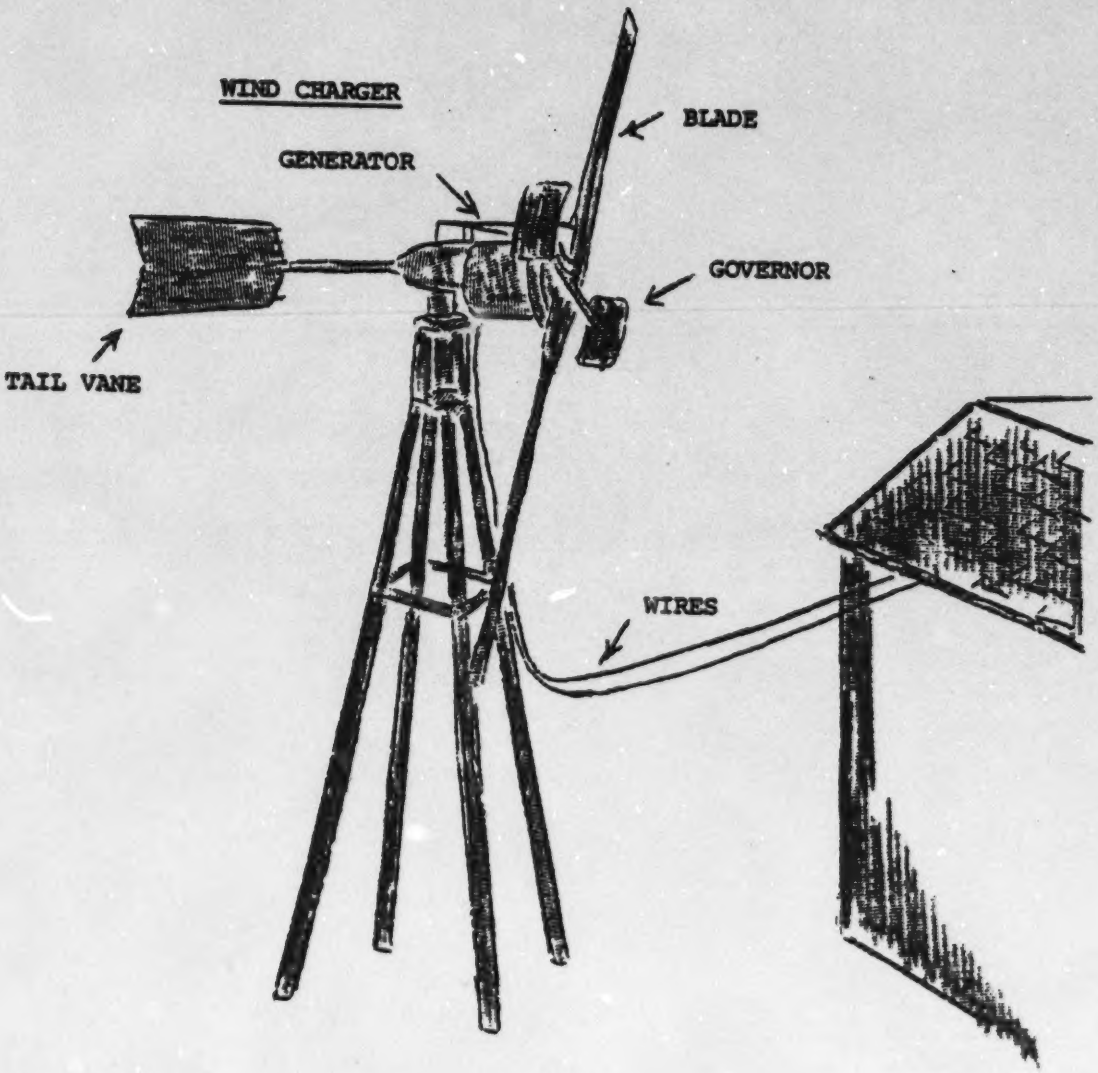


RANCE RIVER TIDAL-POWER PROJECT, BRITTANY, FRANCE

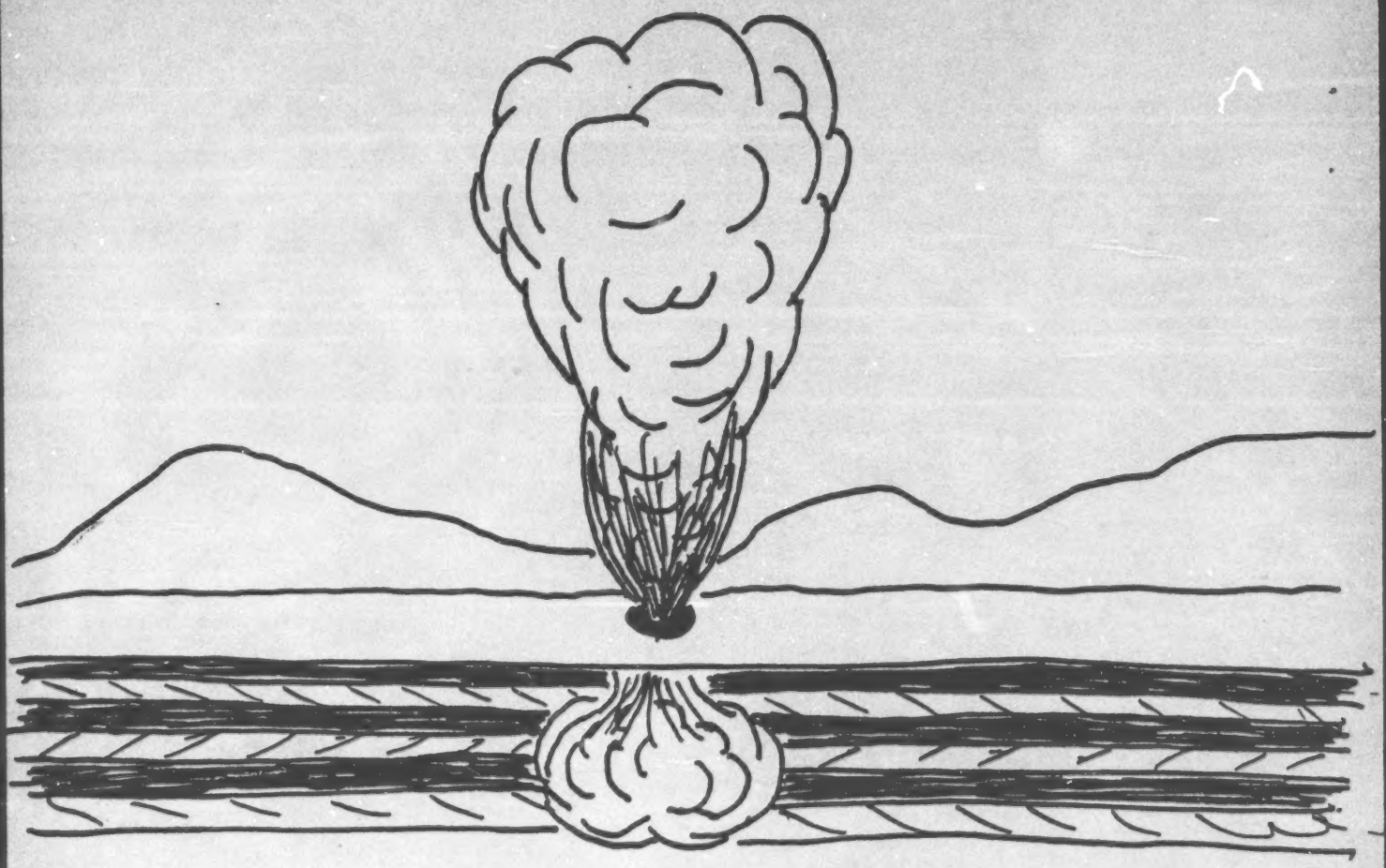
1. Gates are opened for rising tide.
2. When bay is filled gates are closed.
3. Trapped river water then allowed to flow through blades of turbine generator.
4. Electricity is then produced.

WIND

Wind energy has been used by man for hundreds of years. It was used to speed sailing ships across the sea. Windmills were built to grind grain or pump water.



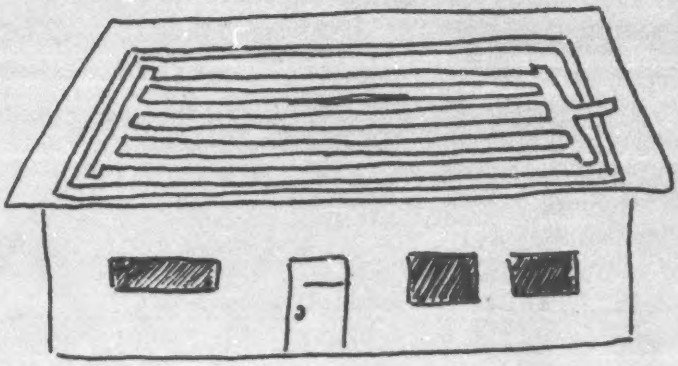
Wind energy is still used in this way by many. But today special windmills called WINDCHARGERS have been invented. Windchargers change wind energy into electricity which can be stored in batteries.



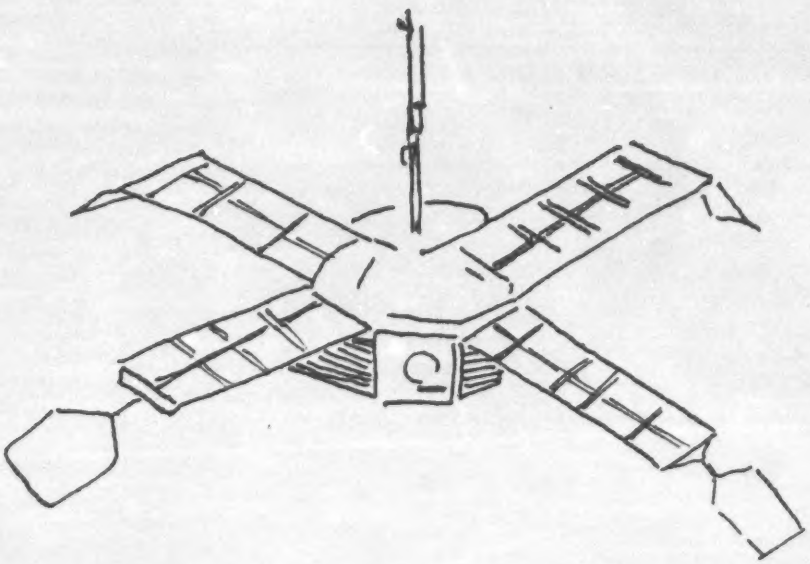
In some areas, the steam from hot springs and geysers are used to power turbines. The burning of wood or garbage is being experimented with as sources of energy to produce electricity.

SUNLIGHT

The final way to get energy without burning fossil fuels is to capture and use the energy of sunlight. This idea is not new, but is being studied more today. Many people are turning to solar devices in order to save fossil fuels.



HOUSE WITH A SOLAR HOT WATER HEATER

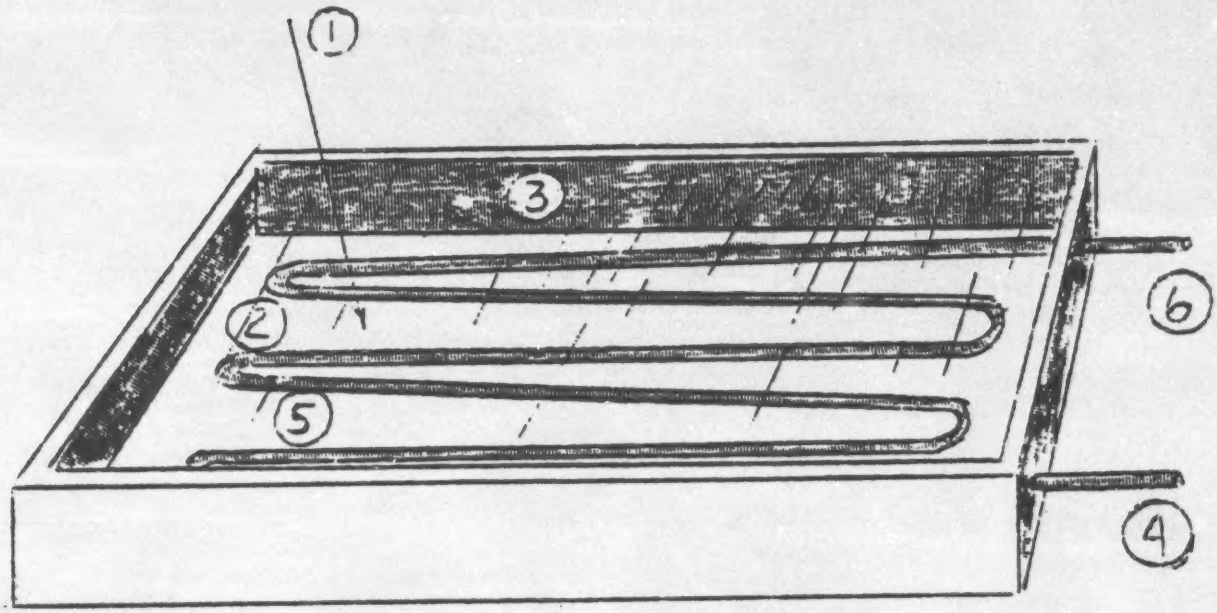


SOLAR SATELLITE POWERED BY SOLAR CELLS

During the 1930's people began to heat household water by sunlight. The roof of a house was used as a solar-collecting area. Many people today are building solar water heaters for their homes.

SOLAR HOT WATER HEATER

The sun's light energy can be changed into heat energy. This is done by allowing sunlight to strike a dark surface. Dark colors absorb or catch the sunlight and change it into heat energy.



This is how a Solar Hot Water Heater works:

1. Sunlight strikes copper pipes and back surface.
2. The inside of the box heats up.
3. The glass cover holds the heat inside the box.
4. Cold water comes into the copper pipes.
5. As the water travels the zig-zag path of the pipes it picks up heat energy.
6. Hot water comes out at this point.

At step #6 the hot water can be stored in an insulated tank for future use.

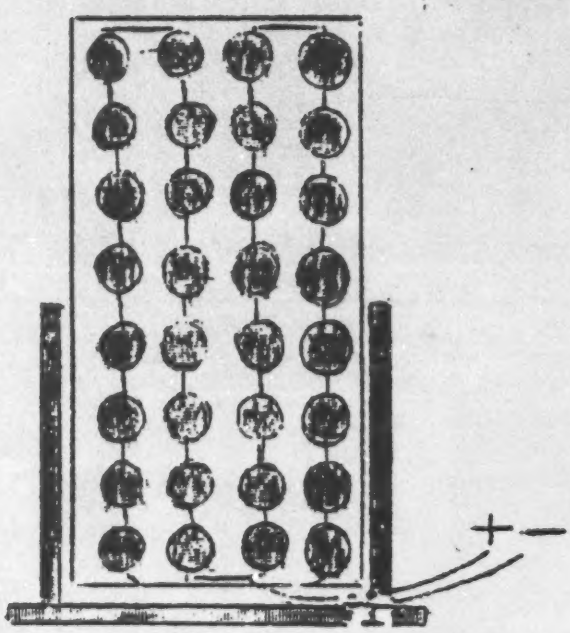
1. What can hot water be used for?

   _____, _____, _____

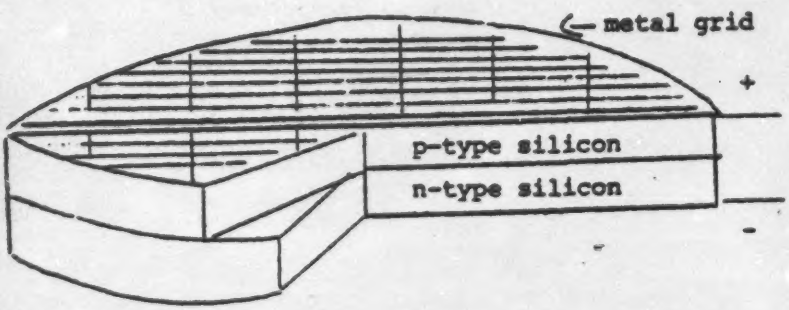
   and _____.

2. The sun's energy is changed into _____ energy which makes the water hot.

SOLAR CELL PANEL



Solar energy can be used to make electric energy. This energy is produced by solar cell panels. Solar cells are the small round discs you see in the illustration. These cells are made of silicon. When light shines on the panel, electricity is produced. Solar cells are wired together in order to produce an electric circuit.



The solar cells have thin strips of silicon. Silicon is an element that comes from sand. The solar cell has a positive and negative layer. (See the picture) This provides a flow of electric current when hooked to a circuit. Solar cells are used on spacecraft, lighthouses, and even to keep batteries in watches charged.

The last experiment in this book is meant to give you a glimpse of the future. It is a simple device that puts the sun's rays to work.

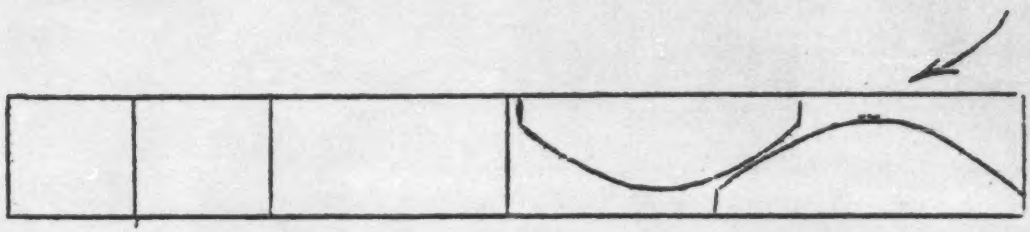
SUN-POWERED HOT DOG COOKER

I. Things You Need:

A piece of "one by eight" lumber 38" long. A piece of sheet aluminum that measures 10" wide by 14" long, (this should be thin-gauge aluminum, the kind sold in hardware and lumber stores). Six to eight 6d nails, and a handful of carpet tacks. Two 3/16" wood screws about two-inches long. A pad of steel wool. A tube of household cement. Some shiny aluminum foil 8½" x 14". A straight edge (a yardstick or a ruler). One wire coat hanger and a piece of sandpaper.

II. Cutting Out The Reflector Sides: (Pattern on Next Page)

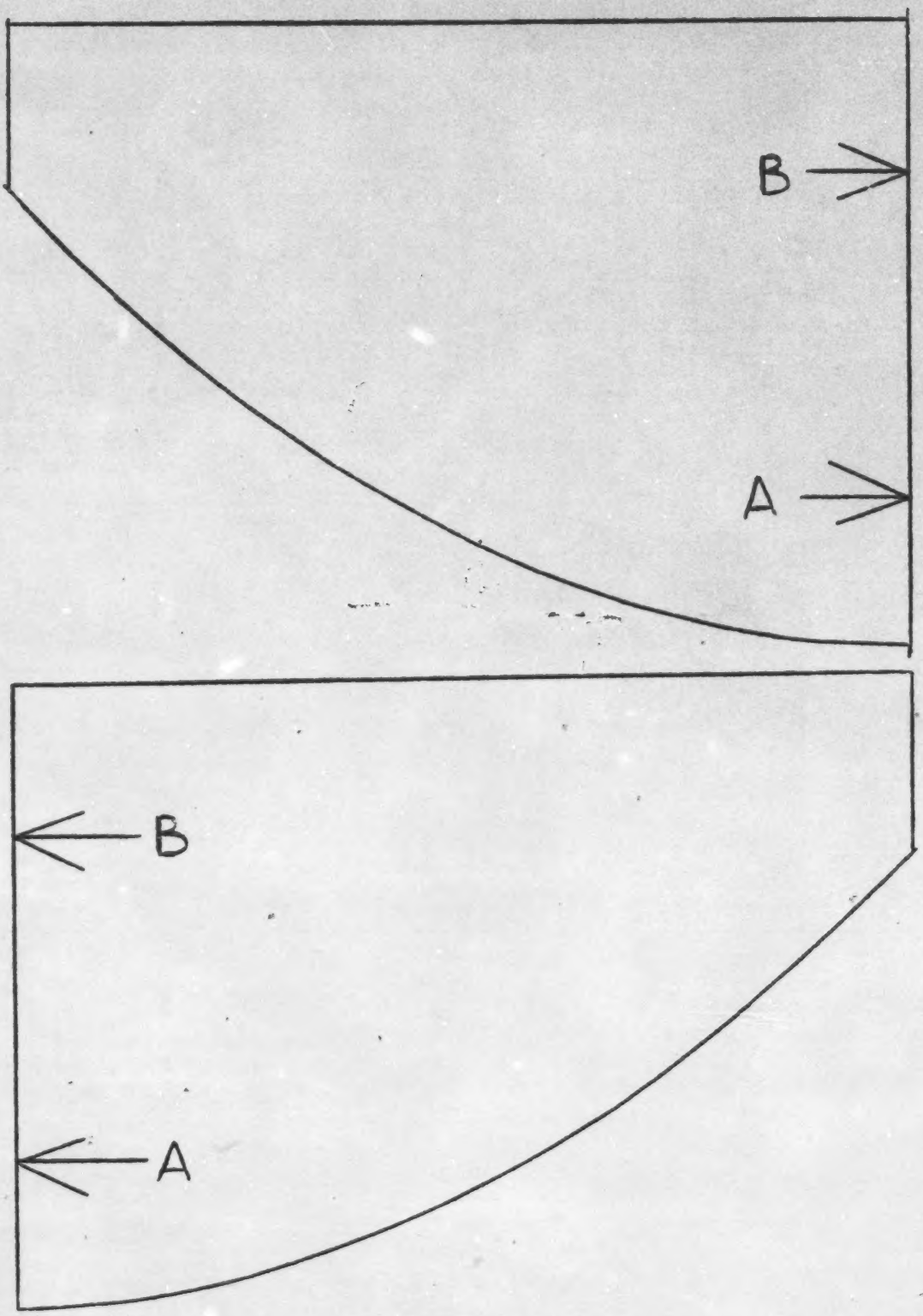
Carefully cut out the side patterns and tape them together by joining AA and BB. Place the completed pattern on the 1" x 8" piece of lumber and carefully trace around the pattern. Cut out the two sides. To conserve lumber, place the pattern on the board like this:



III. Drilling the Sides

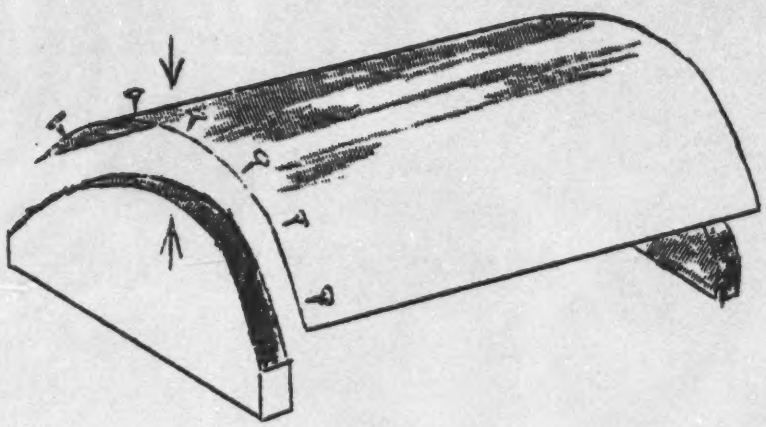
The sides are now ready to be marked for drilling. Again, place the pattern over each side. By using a sharp object, such as a compass point, punch through the pattern at the -><- at AA and BB to mark the lumber. At AA drill a 3/16" hole. At BB drill a 1/8" hole. Do this for both sides.

SIDE PATTERN



IV. Nailing the Reflector Together:

Now, place the aluminum sheet over the curved edge of one side. Nail the two together. Do the same for the other reflector side. Be careful to line up correctly the 14" edge of the aluminum to the outside edge of the reflector sides. Use the diagram below.

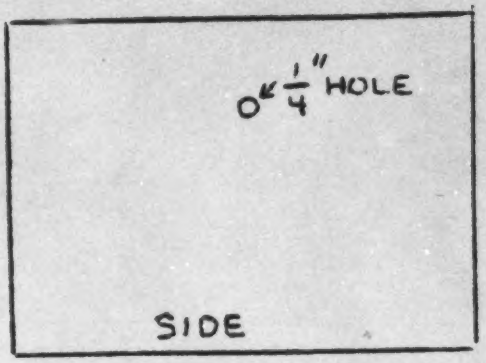


V. Gluing the Aluminum Foil:

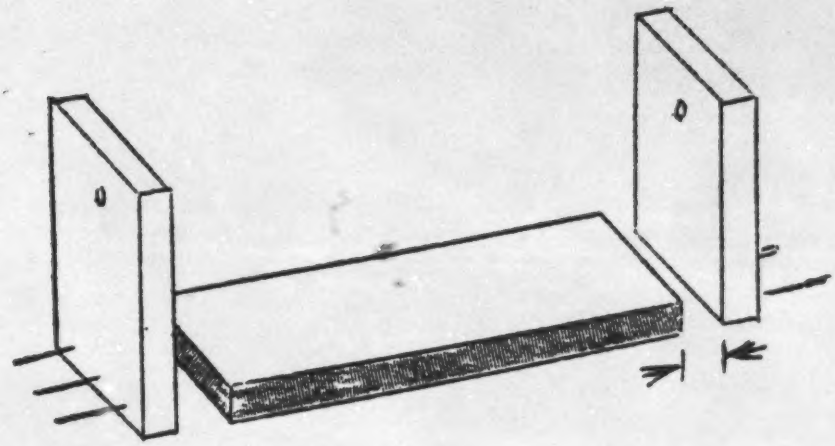
Now take the steel wool pad and gently rub the inside aluminum surface of the reflector. Wipe out dirt and dust and lightly apply several zig-zag lines of household cement inside the reflector. At this point, take the aluminum foil (shiny side out) and apply inside the reflector. With a soft cloth carefully smooth out the aluminum foil against the back of the reflector.

VI. Building the Reflector:

STAND - Now cut the sides and base of the reflector stand. Cut 2 pieces of the 1" x 8" each 4" long. Also cut the bottom length at 10¼". Drill a ¼" hole in each side 1" from the top and in the middle of the board.

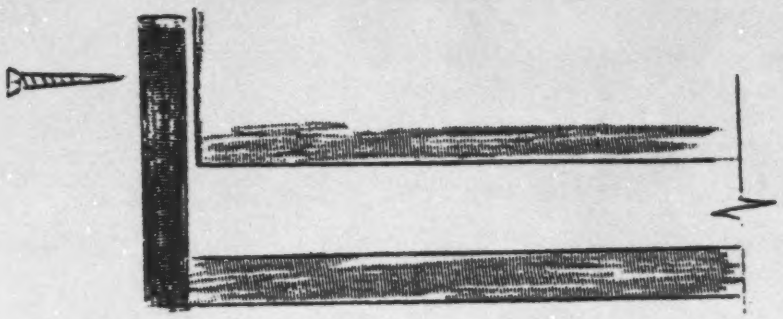


Now nail the sides into the bottom using the 6d nails.



VII. Fitting the Reflector to the Base:

Place the reflector inside the stand and insert the two large wood screws through the sides. Turn the screws into the AA holes in the reflector sides. (DO NOT TIGHTEN SCREWS TOO TIGHT)



VIII. Fitting the Skewer

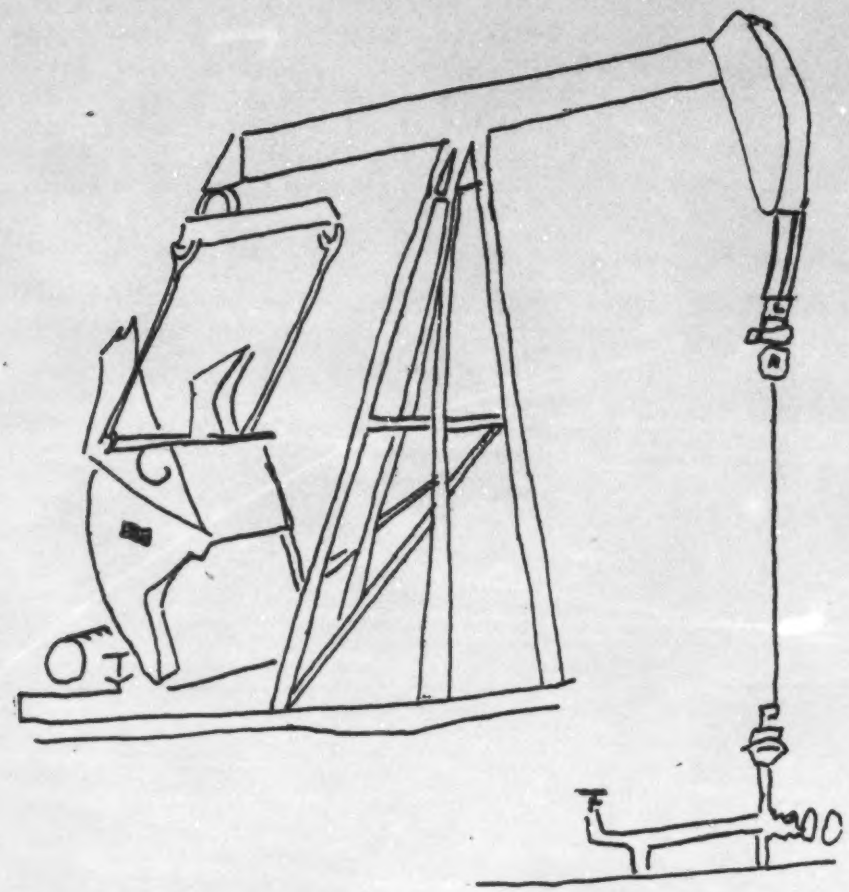
Now take the coat hanger and cut out a 14" length. Sand it down to bare metal and fashion a hook on one end.

Place the skewer through the BB holes. Your cooker is now complete and ready. To use simply draw the skewer back several inches and run the skewer through a hot dog and then into the opposite BB hole. Aim the cooker into full sun and turn the skewer as needed while the hot dog cooks.

(Adapted from: Energy Conservation: Experiments You Can Do. The Edison Foundation in Southfield, Michigan)

We have been talking about future sources and uses of energy. Your teacher will be showing you a filmstrip called "Energy, Environment and the Future." It will give you an oppotutnity to think about the way we are now using energy. The filmstrip will also tell about more efficient transportation systems and energy-saving buildings.

You will begin to think about the future. There are problems of shortages to overcome.



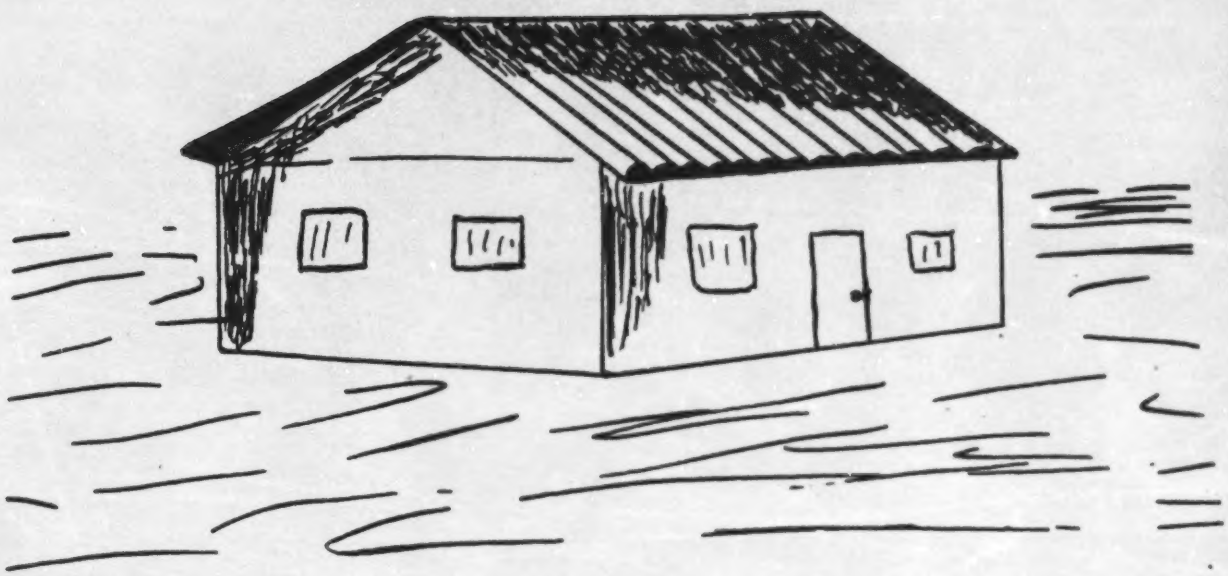
L.A.P. SIX
HOW INSULATION WORKS

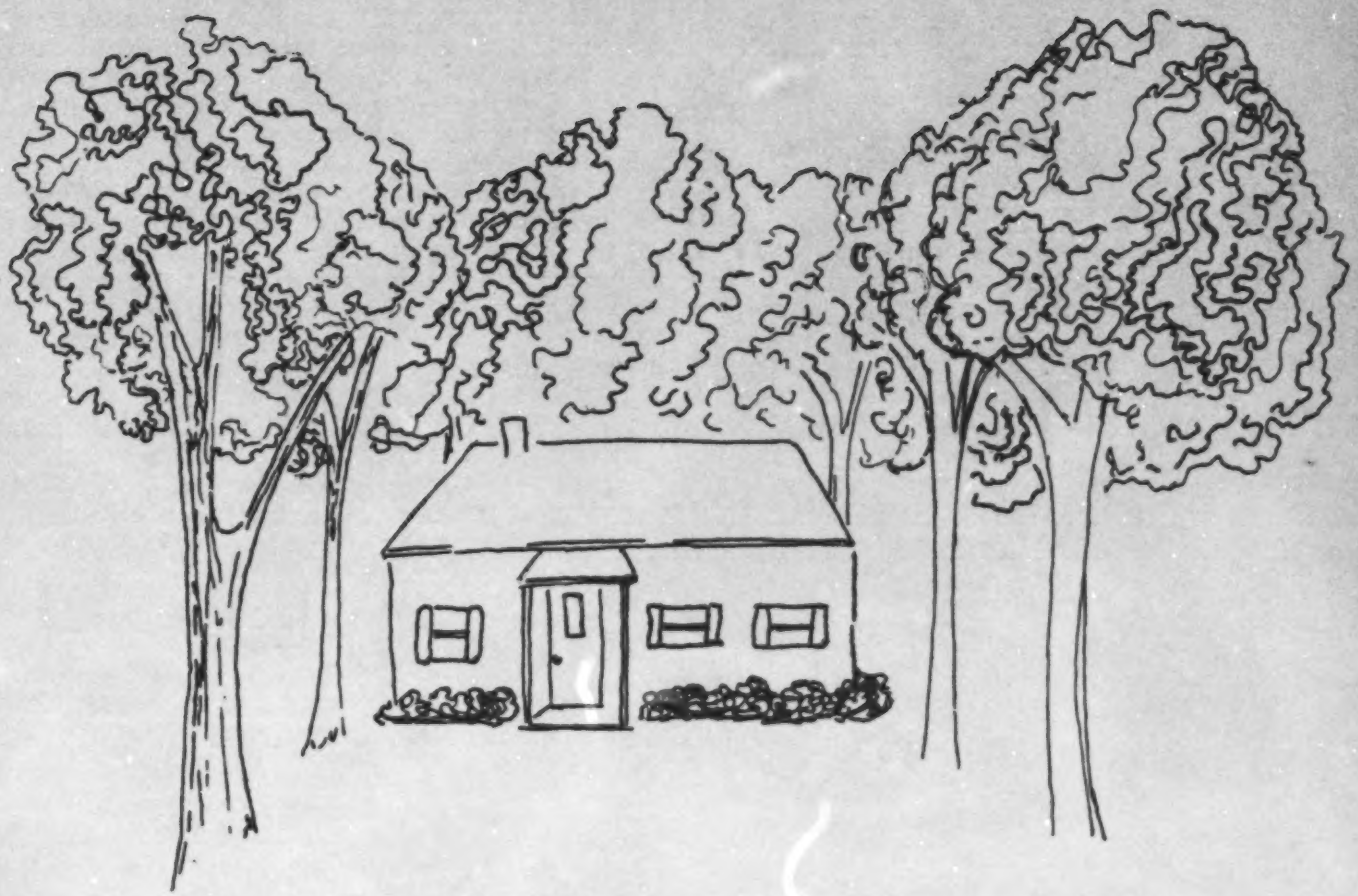
One way of saving energy was mentioned in the filmstrip. This is to use insulation. This section tells you more about this energy-saving device.

Americans are more dependent on appliances than people of any other nation in the world. Our appliances are major users of energy. Americans use 1/3 of the world's energy.

Appliances use a lot of energy. The heating and cooling of buildings are the top energy users. Because of poor insulation, buildings lose this warm or cool air. This makes the heating and cooling units run even more.

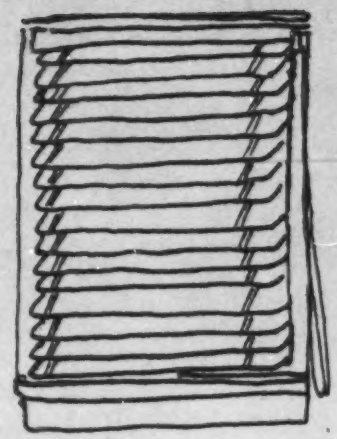
What can be done to stop this waste? Solar energy can work for or against us. Sunlight can be used in the winter to heat without using solar collectors and heat storage devices. At the same time it is possible to use different kinds of shade to keep out sunlight in the summer.





Trees and bushes make good summer insulation. Shady trees on the east, south and west sides of the house would be good in the summer, but not in the winter. It is best to use trees that drop their leaves in the fall. This allows sunlight to reach the walls.

WINDOWS

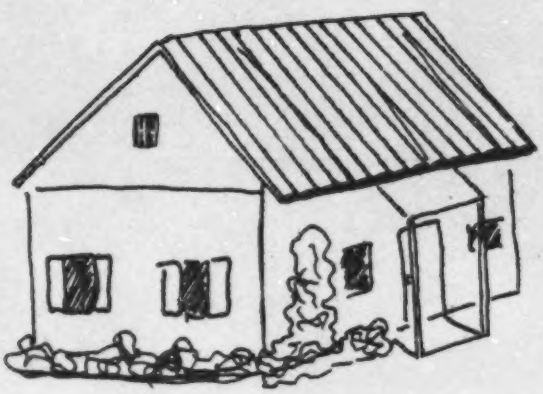


The best way to control sunlight is to catch it before it strikes the windows. This can be done by shading, outside shutters, awnings, outside venetian blinds and a special type of window screen known as the shade screen. In the shade screen the wires are replaced by thin narrow strips of metal. They are held in place at a fixed angle and keep sunlight from passing through until the sun is quite low in the sky.

Other defenses against sunlight are at the window surface, such as a "sun control film."

A final defense against sunlight is the use of shading devices on the inside of the window. These include window shades, venetian blinds and full length draperies.

ROOF



If the right kind of insulation is applied to the exposed roof, the heat flow can be slowed down. The temperature of the inside roof surface can be lowered.

The attic spaces serve a useful purpose in controlling roof heat. The roof acts as an umbrella. If the attic space has a vent, then the outside air can enter the space and replace the warmer air trapped there. The worst type of roof would be a thin layer of metal between the person and the sun.

LAB ACTIVITY

HOW DOES INSULATION WORK?

Materials Needed: Small water glass, thermometer (must be waterproof - fishtank type will work), small cardboard box (corrugated), package of cotton balls.

Fill the glass with water that is at room temperature, measure the temperature. With the thermometer in the glass, place the glass in the refrigerator. Check the water temperature every five minutes. You will find that the water temperature drops quickly. The reason is that heat is flowing out of the warm water into the cold air inside the refrigerator.

Now, refill the glass with water again. Place a layer of cotton balls inside the cardboard box and rest the glass on top of the cotton. Pack the empty space between the glass and the sides of the box with more cotton balls.

Once again, measure the temperature of the water with the thermometer and place the box in the refrigerator. Measure the temperature of the water every five minutes.

You will find that the temperature of the water is dropping much less quickly. The cotton insulation is slowing down the loss of heat from the water.

USING THE SUN TO HEAT A HOME

Materials Needed: A shoebox, thermometer (fishtank type), plastic food wrap, scotch tape, cloth large enough to cover the open side of box.

Tape a piece of plastic wrap across the top of the box. The plastic sheet should be smooth and wrinkle free.

Punch a small hole in the end of the box and slip the thermometer in the box.

Place the box on a sunny windowsill and watch the thermometer. The thermometer should rise.

Repear the experiment, but cover the box with the cloth. This time the temperature will climb very slowly.

In this same way the sun can be used to heat a house in winter, but on cloudy days and at night curtains should be closed to act as insulation and help keep the heat inside.

ENERGY USE IN AMERICA

Mankind has used more energy in the past thirty years than in all history before 1940. In the next 30 years we will use even more. In the last fifteen years, total use of energy in America doubled. In the next 15 years it is expected to double again.

1. What problems will this cause? _____

_____

2. The U.S.A. has 1/12 of the world's population and uses 1/3 of the world's energy. What problems does this cause?

_____

_____

_____

USE AND COST PER MONTH FOR ELECTRICITY

Follow these Coloring Directions: On the next page you will find pictures of various appliances that are used in many homes. Some will be in your home and some may not.

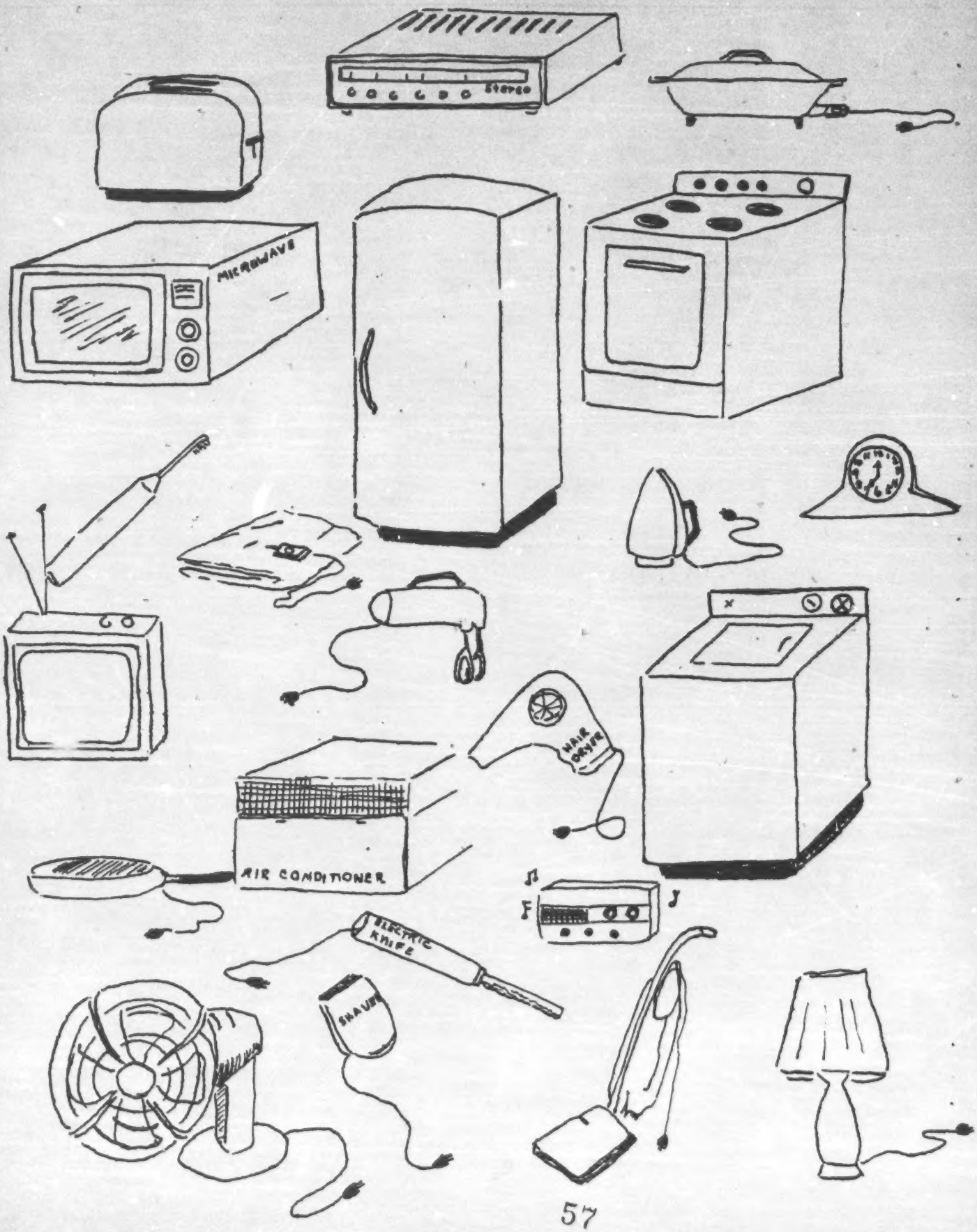
1. Color all appliances that use a large amount of electricity RED.

2. Color all appliances that use a smaller amount of electricity ORANGE.

3. Color all appliances that use very little electricity YELLOW.

4. UNDERLINE all appliances you have in your home.

5. CIRCLE all appliances in your home you could do without or find a better substitute for.


MICROWAVE
AIR CONDITIONER
HAIR DRYER
ELECTRIC KNIFE
SHAVER

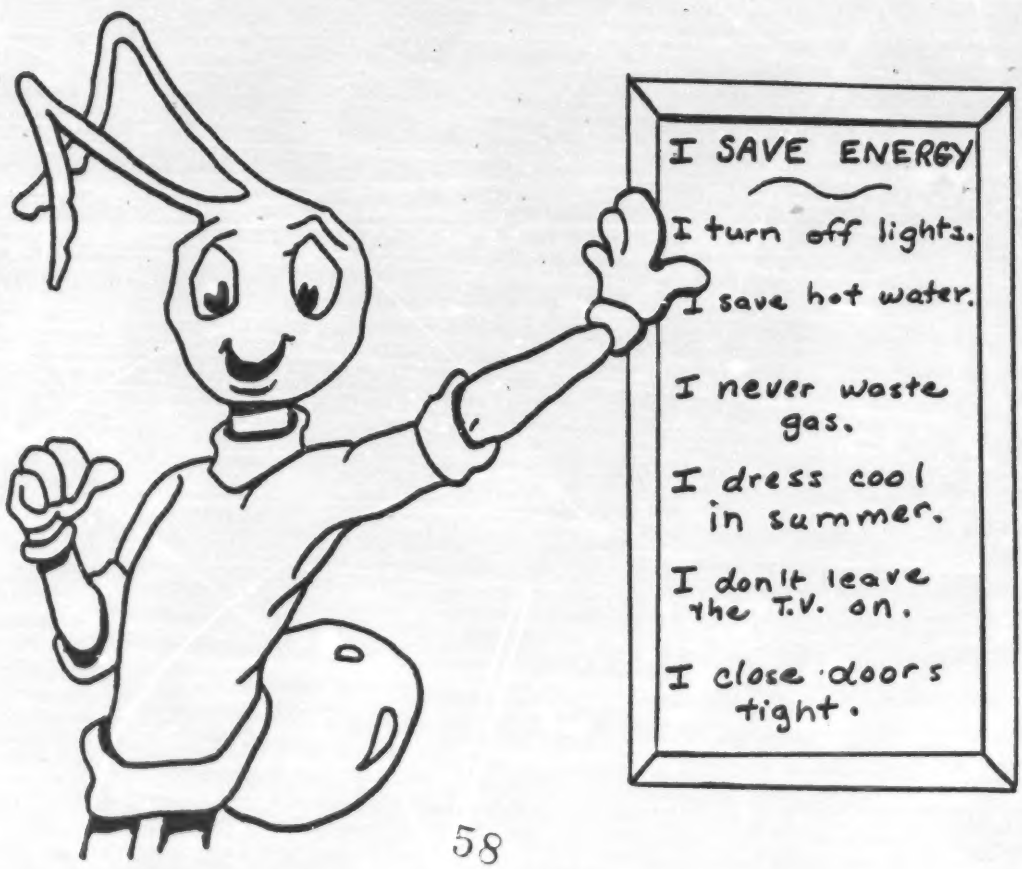
With your classmates and teacher, you have been studying what energy is and how we use it. It is very important to our country to have a large supply of energy. Energy is a part of everything we do. We need energy to light our homes and schools, to run our busses, cars and planes, and to run our factories and farms. We all need energy in the form of food in order to live. A great many people work at jobs that keep us supplied with fuel, food and electric power.

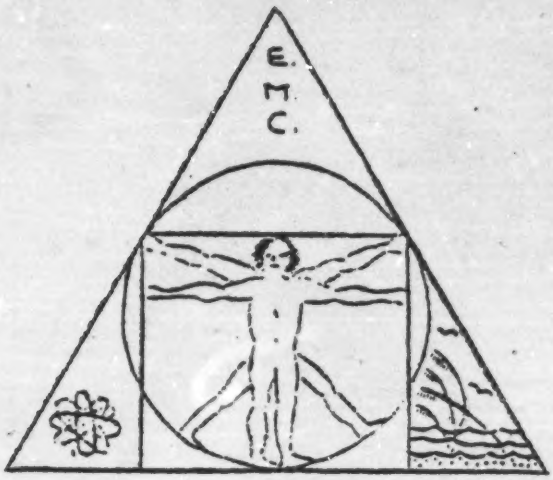
In your study of energy, you learned that the green plants of millions of years ago captured the sun's energy. That energy is stored now in the fossil fuels of coal, oil and natural gas. But we are rapidly using up our fossil fuels. In the future, we will have to turn to other sources of energy. Energy from the sun, wind, ocean currents and energy from the atom will help us in the future to run our homes and factories.

Until that time, it is important that we all conserve our energy sources. We should never waste our energy supplies. Can you think of ways that you can save energy? The more energy we save now, the more we will have for our future needs.

Continue to study energy around your home and school! Try to visit a power plant or farm and trace where the energy comes from and where it goes.

BE AN ENERGY ANT!


I SAVE ENERGY
I turn off lights.
I save hot water.
I never waste gas.
I dress cool in summer.
I don't leave the T.V. on.
I close doors tight.



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The booklet is designed to be used by students and teachers in a classroom setting.

All materials are in a preliminary pilot form and may be revised.

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